ELECTRICAL REVIEW

621.3
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John Thompson Water Tube Boilers Ltd., one of the seventeen companies in Britain in the John Thompson Group, have unrivalled experience of the widely varying requirements of industrial and power generating water tube boiler plants.

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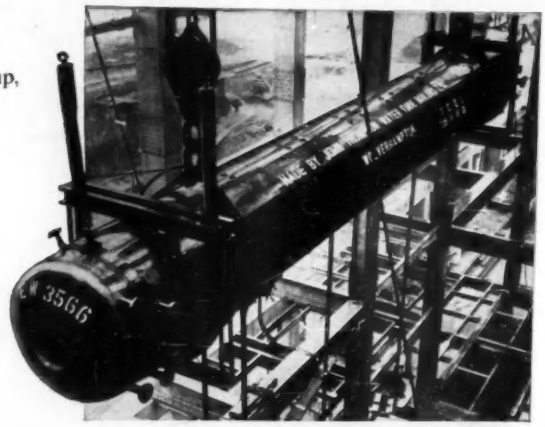
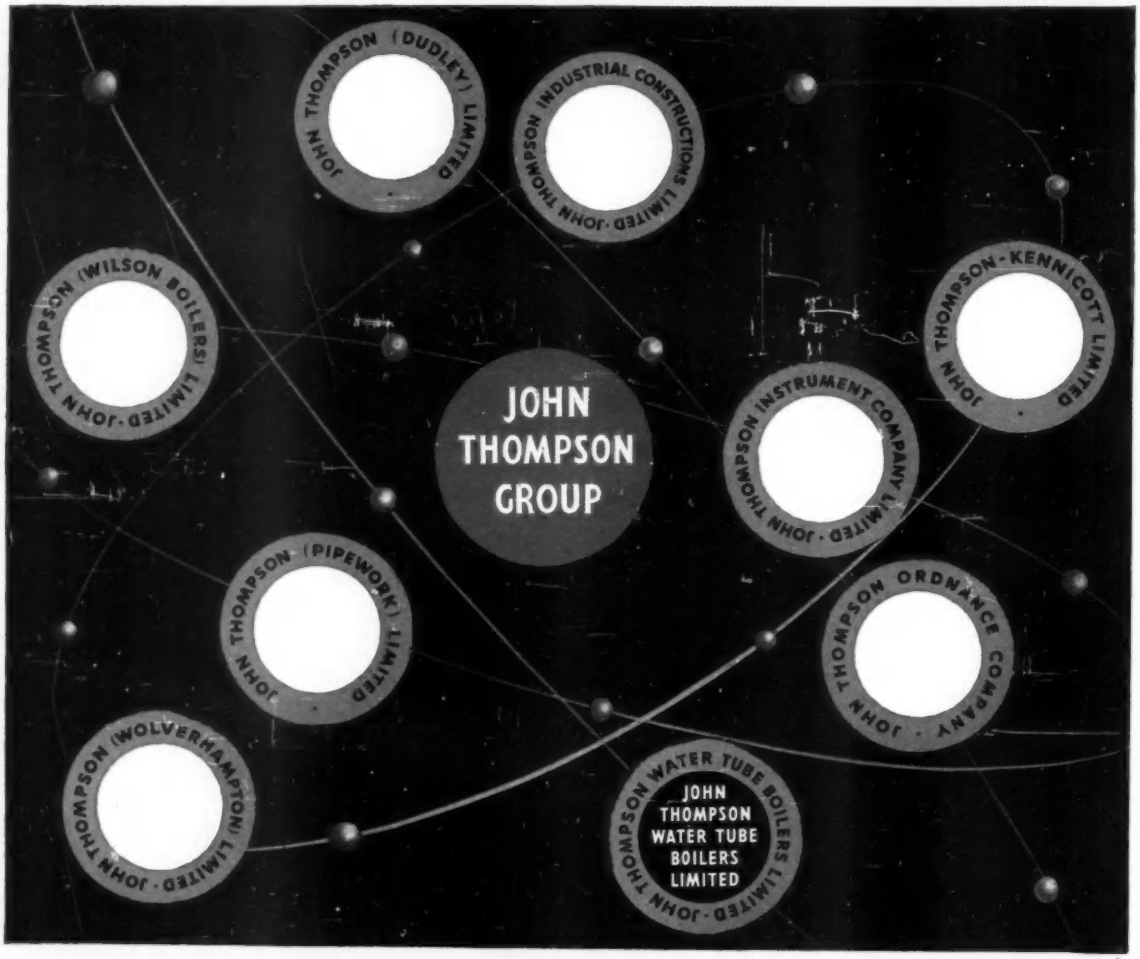


JOHN THOMPSON WATER TUBE BOILERS LTD., WOLVERHAMPTON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The world's largest turbo-generator for Britain

The Central Electricity Generating Board have ordered a PARSONS 550,000 kW turbo-generator to be installed in the projected Thorpe Marsh Power Station, Yorkshire. This machine, the largest generating set in the world, will consist of two lines arranged in line ahead, each line comprising four cylinders driving a 275,000 kW three phase generator.

Parsons have also received the order to construct the condensing and feed-heating plant for this machine.

Steam conditions:—

Pressure:	2,300 lb/in²
Temperature:	1,050° F
Reheat:	1,050° F
Exhaust Vac:	28·7 in. Hg.

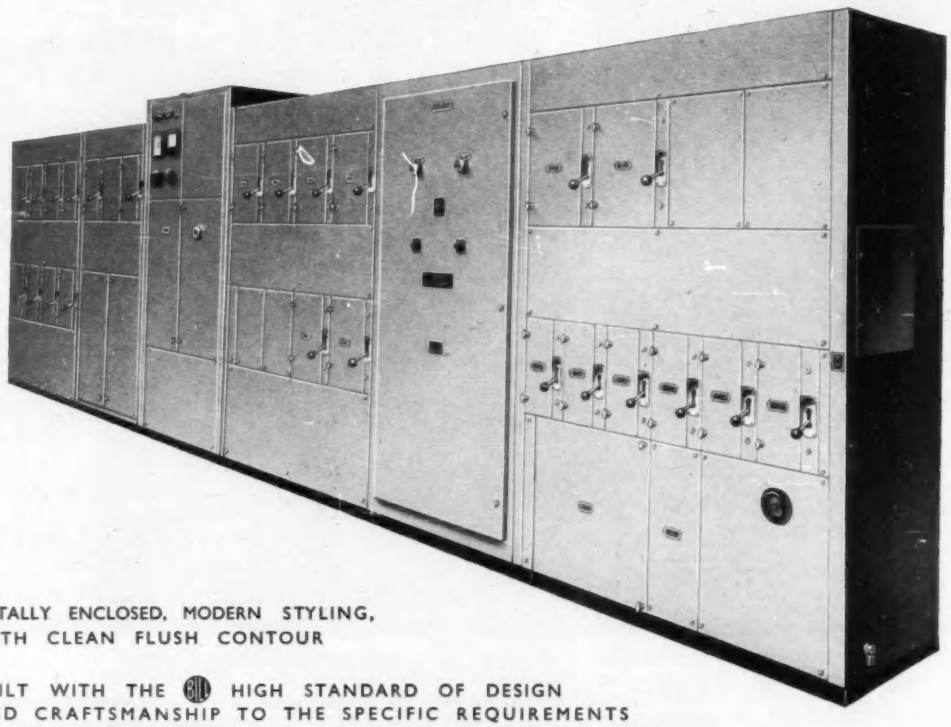
All eight main cylinders will be of the double flow type with high pressure cylinder on "A" line taking the 550 MW steam flow. Exhaust steam from this cylinder will be reheated and passed to the first intermediate pressure cylinder on "B" line. Thereafter the steam divides equally between duplicate second intermediate pressure cylinders, one on each line, final expansion of the steam being through two low pressure cylinders on each line.
Each generator will operate at 18,000 volts ·85 P.F.: 50 cycles per second at 3,000 r.p.m. Stators will be hydrogen cooled with direct water cooled windings. The rotors will be direct cooled.

PARSONS

C. A. PARSONS & COMPANY LIMITED · HEATON WORKS · NEWCASTLE UPON TYNE 6

You cannot buy better gear

BILL MAJESTIC CUBICLE TYPE HEAVY-DUTY SWITCHBOARDS



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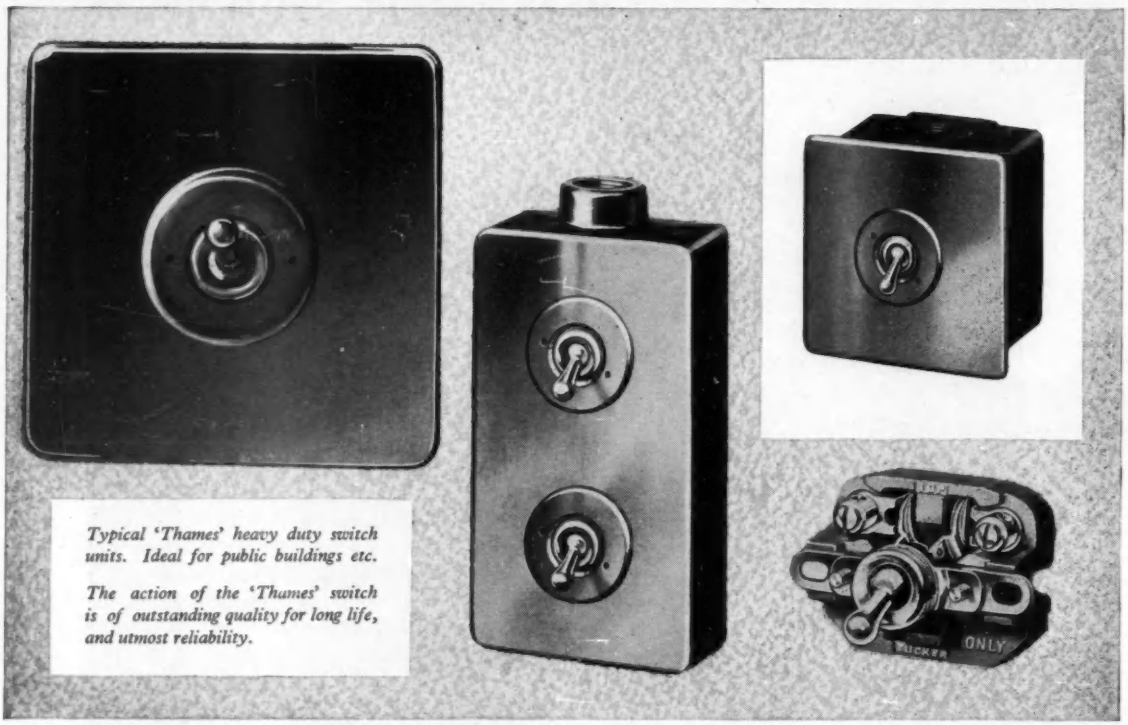
For top quality controllably silent AC switches—the 'THAMES' RANGE



Typical 'Thames' heavy duty switch units. Ideal for public buildings etc.

The action of the 'Thames' switch is of outstanding quality for long life, and utmost reliability.

THE 'THAMES' RANGE is a series of superlative quality flush AC switches and flush and surface switch assemblies. They are designed for heavy duty and are controllably silent in operation and enduring in service.

A valuable feature is the large flange locking ring which can be locked as a protection against unauthorised removal or tampering.

The 'Thames' range is ideal for schools, hospitals and other public buildings. One and two-way types are available, 5 amps, 250 volts.

Tucker TELAC MEM KERSON

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MIDLAND ELECTRIC MANUFACTURING CO. LTD., ACCESSORIES DIVISION, REDDINGS LANE, TYSELEY, BIRMINGHAM II.

'Perspex' lighting fittings made by Ionlite Ltd. and Suntex Safety Glass Industries Co. Ltd., for National Provincial Bank, Southsea.

This modern bank uses 'Perspex' lighting fittings

THIS MODERN BANK uses modern lighting fittings. They're made from 'Perspex' acrylic sheet to last and remain attractive throughout a long life. 'Perspex' is a tough, light material, a material unaffected by atmospheric changes. It is easy to clean and maintain.

Because it is so attractive and because it is easy to shape, 'Perspex' is a material which offers great scope to the inventive designer. The lighting fittings in this branch of the National Provincial Bank demonstrate that point. Good lighting is essential wherever close figure work is done and in this Bank 'Perspex' has helped to achieve this result efficiently and elegantly.

'PERSPEX'

'Perspex' is the registered trade mark for the acrylic sheet made by I.C.I.

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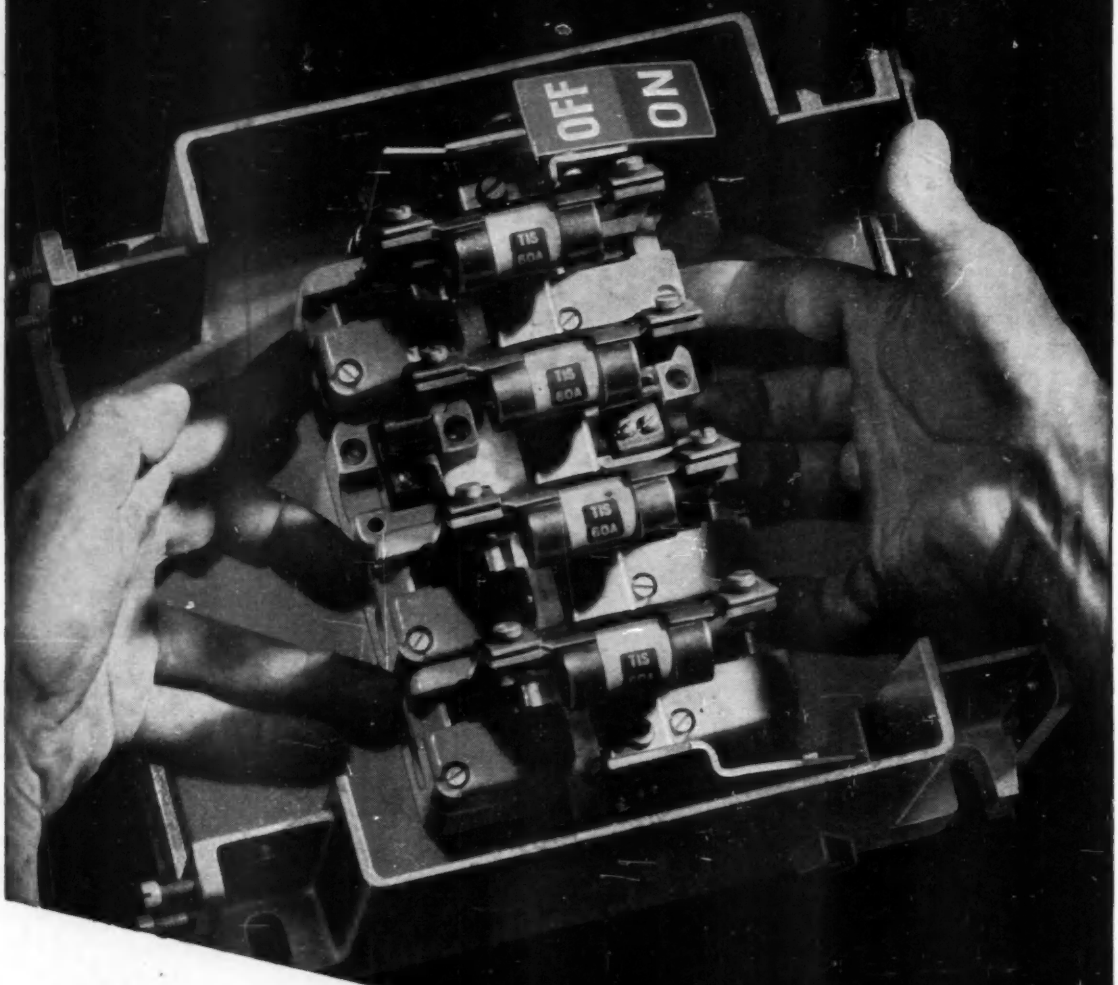
everything has to be CONTROLLED



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A camera view of the 'Sandaclad' one of the most modern and praiseworthy designs in the Sanders range.

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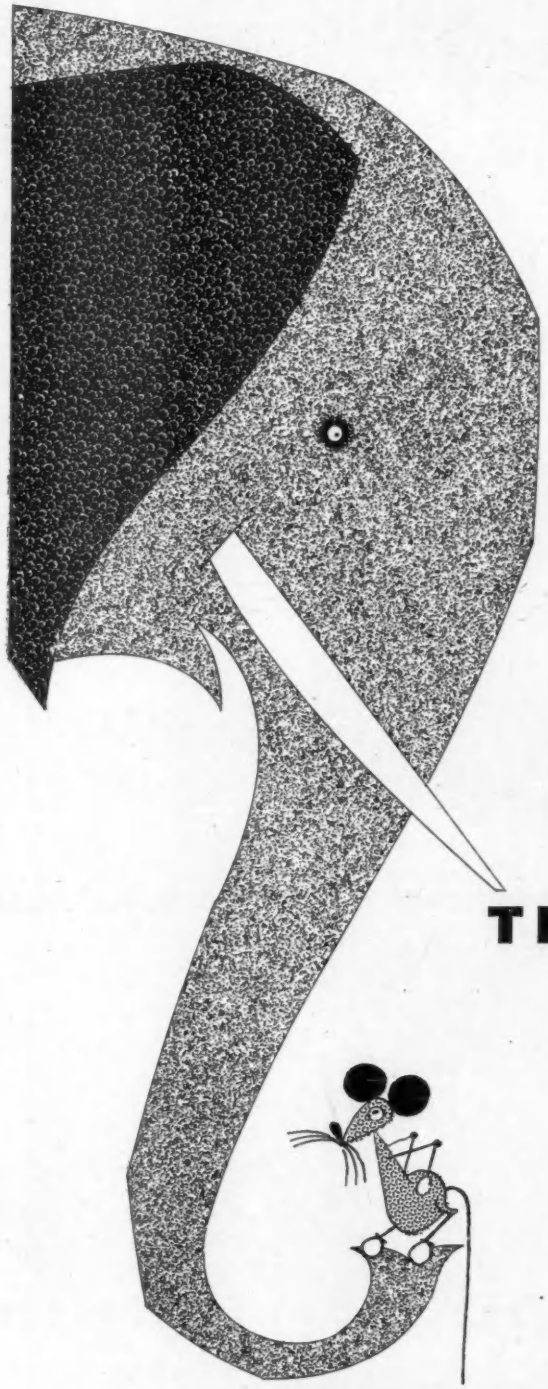

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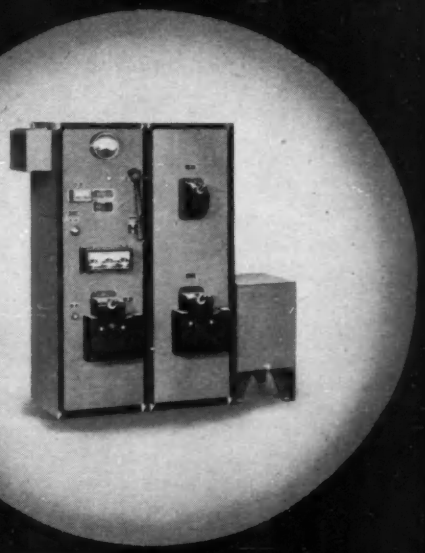
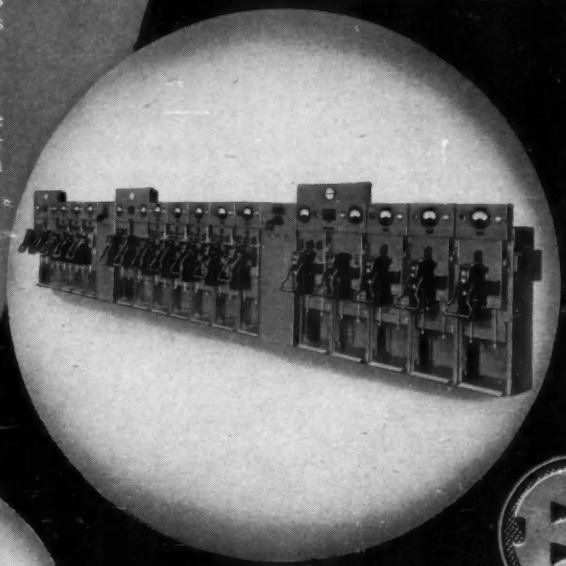
Specify "Erskine Heap"

FOR UTMOST RELIABILITY
with minimum maintenance costs

Here you will see three examples of the range of SWITCHGEAR and MOTOR CONTROL GEAR that we cover. In the top illustration is a 1050 H.P. KORNDORFFER type Auto-Transformer Starter.



The middle illustration shows 400 Volt Vertical Isolation Switchboard containing CIRCUIT BREAKERS ASTA tested to 25 MVA at 400 Volts to BSS. 116.



Below is one of our contactor type direct-on STARTERS. All our Starters and Switchgear are fitted with magnetic type solenoid overloads.

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E.H.T. SWITCHGEAR up to 11kV
250 MVA rupturing capacity
MOTOR CONTROL GEAR
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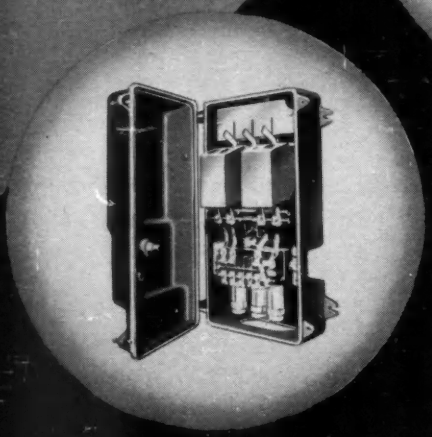

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Switchgear Specialists

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A700

Fire

Contractors—this is **your** business! **Profitable business** can be obtained by installing Gents' Fire Alarm Systems. Efficient, reliable and economical, simple systems are easily installed which comply with the Factory Act. Where necessary the free services of our Technical experts are available for surveying the premises.

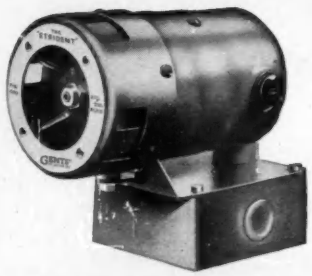
Typical Fire Alarm Contact

Specially designed as a neat, small Fire Alarm Point, with precious metal contacts and substantial springs for **complete** reliability even after years of installation. Each contact will operate a maximum of 3 Strident syrens on 200/250v AC.

PRICE £2. 10s. 0d.

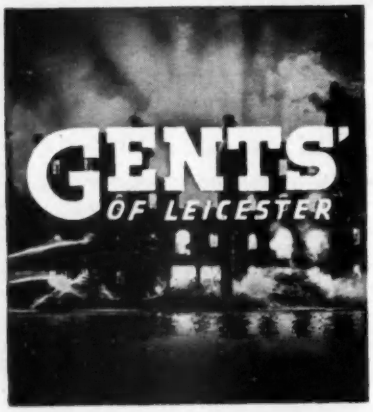
The "Strident" syren is ideal as a Fire Alarm signal and overcomes most noise levels. Only takes ¾ amp with consequent saving in wiring and current consumption. Totally enclosed motor for indoor use only, continuously rated. Base box drilled for ¾" conduit fitted with knockouts and can be turned through 90° to conform to conduit run.

PRICE 200/250 volts AC/DC (¾ amp consumption) **£7. 0. 0.**
24 volts DC (2 amp consumption)



The "STRIDENT" Syren

Alarms



Our informative booklet "Are You Protected?" *will give you further information on installing Gents' Fire Alarm Systems together with sample schemes. Write for your free copy without delay.*

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Each heater has a power output control to adjust impedance matching of the loads giving optimum conditions for a wide range of applications.

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THE 18 kW HIGH FREQUENCY INDUCTION HEATER

For efficient process heating use

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COLD HEADED BOLTS & SETSCREWS

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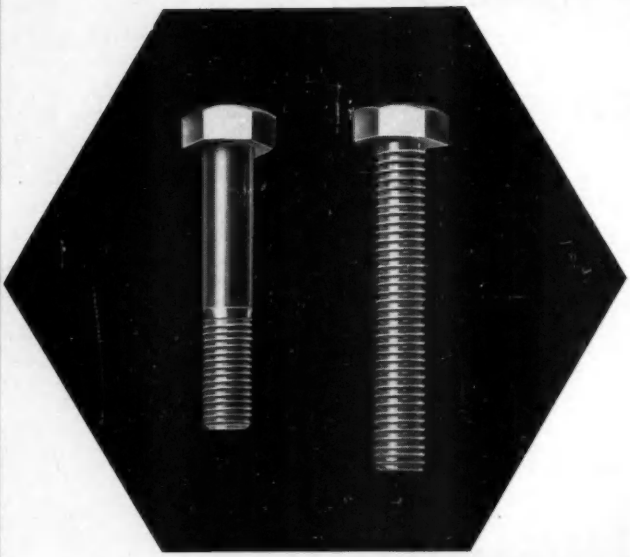

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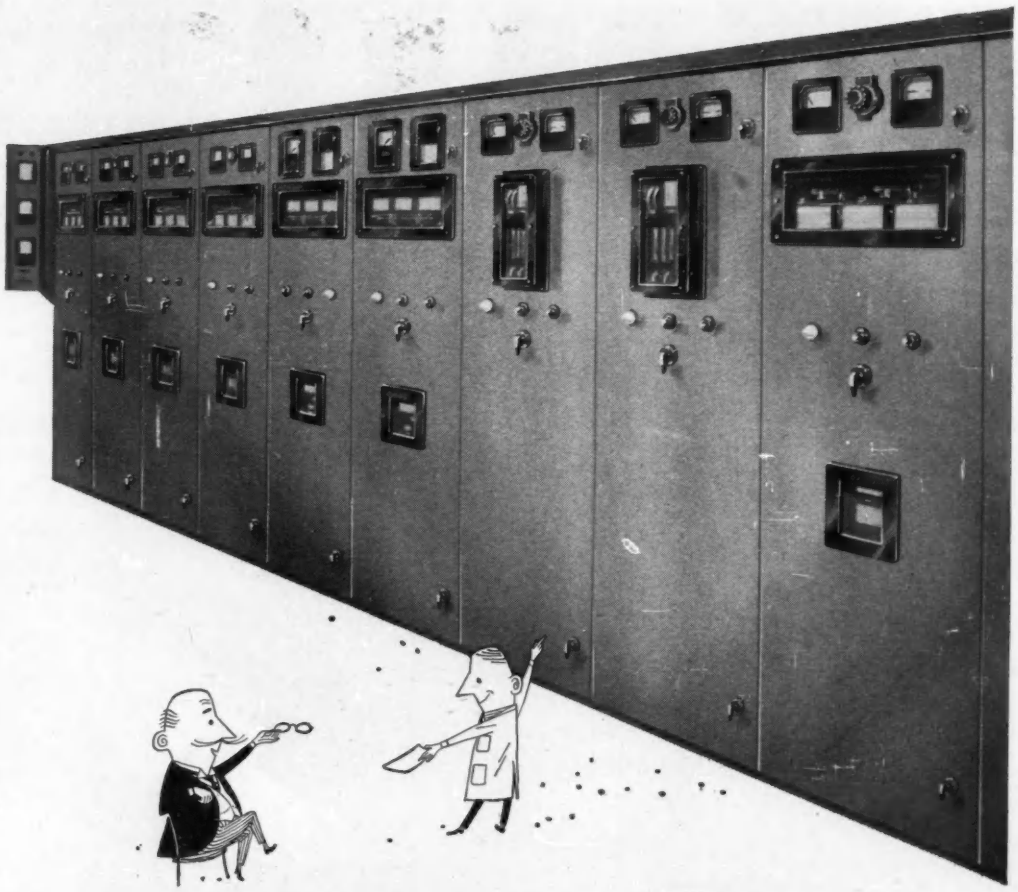

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Well sir, by ordering standardized switchgear from Brush you get better delivery. You get uniform, clean appearance, too. And you get a better price.

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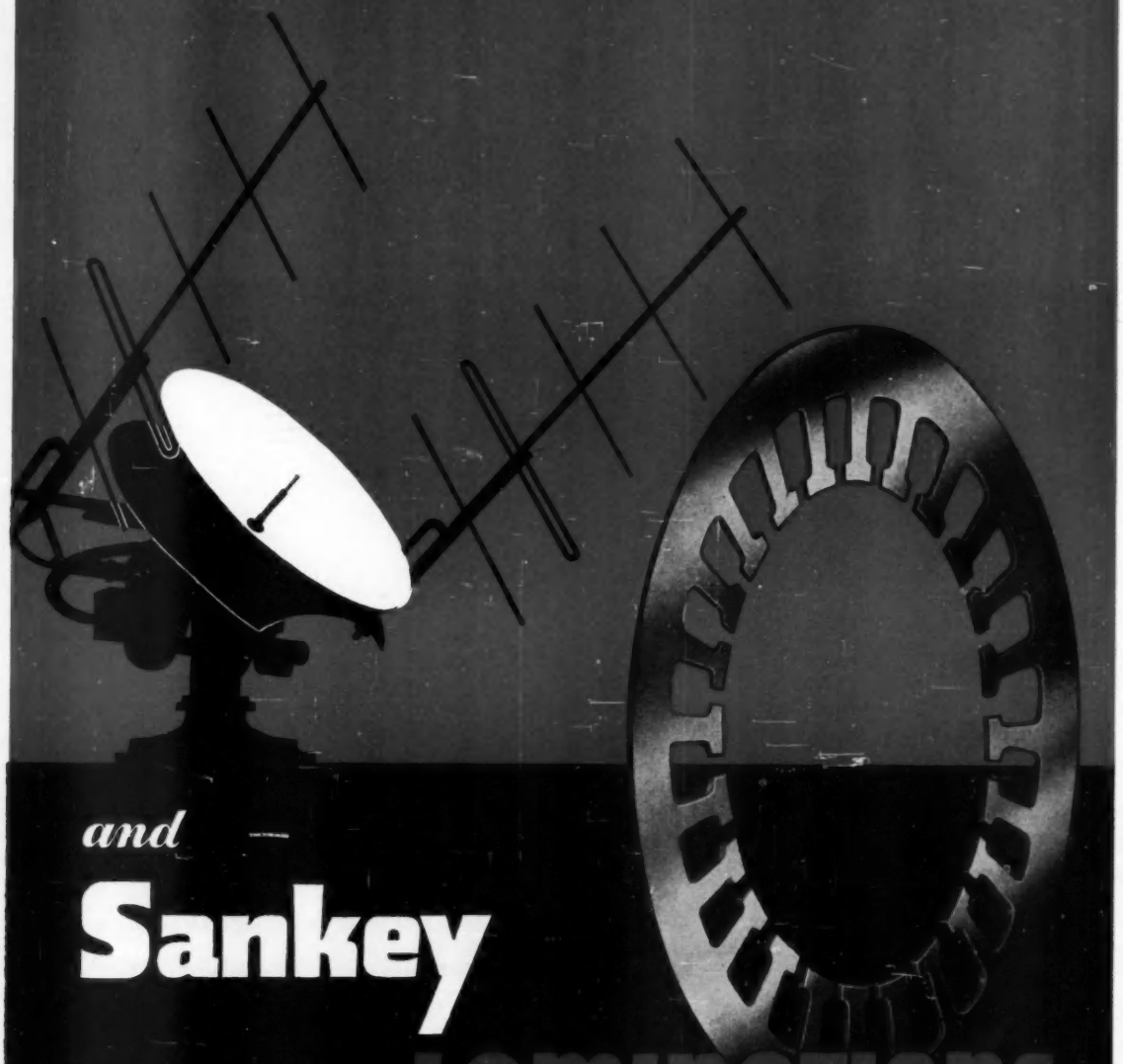

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MODEL 260

The luxury washer that washes, rinses, spin-dries in one tub

AT THE TOUCH OF A TOE!

Right in the fashion for spin-driers—indeed ahead of a fashion created by Thor twelve years ago—is this washer and spin-drier in one. No handling of wet clothes from washer tub to spinner. It's all done in one tub—now with foot pedal control! It's Britain's most outstanding washer, topping the market with 7 big sales plus features.

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2. **UNIQUE OVERFLOW RINSE:** Adds continuous clean water, circulated by the agitator — a major feature exclusive to Thor.

3. **BUILT-IN SPIN-DRY:** Another major feature of "Automagic's" three - in - one - tub operation.

4. **SUDS-SAVER:** With this ingenious device, hot soapy water can be used again to wash a second load.

5. **CONCEALED INLET SPOUT:** The inlet spout is placed inside the cabinet to improve styling and operating convenience.

6. **SMOOTH ACTION CLUTCH:** An external friction clutch of improved design gives a smooth acceleration to top spinning speed and allows the gyro-disc balancer to stabilise the machine throughout the spinning operation.
The clutch also offers a very high degree of protection against overload on the motor.

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a lightweight fibrous silica material of very fine diameter, is being increasingly applied as a flexible high temperature electrical insulator. It is capable of withstanding continuously temperatures in the order of 1,000°C, or for short periods, even above. As well as being an excellent high temperature electrical insulator, Refrasil has outstanding thermal insulation characteristics at elevated temperatures. Like fused silica it has a high resistance to thermal shock and to chemical attack from acids. It is available as batt, felted wool, cloth, tape, sleeving, bulk fibre, cord, and yarn. There are many other things well worth your knowing about Refrasil; we have incorporated them all in a brochure which we would like to send you.

REFRASIL

THE BRITISH REFRASIL COMPANY LIMITED
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873

REFLECTIVITY

unimpaired by thermal and chemical attack

VERITYS *introduce*

MAXLUME ALUX *reflectors*

to overcome every problem in controlling light and radiant heat

SWEEPING CLAIMS? HERE ARE THE FACTS TO SUBSTANTIATE THEM

1. The Maxlume Alux reflector is impervious to thermal or chemical attack, thanks to the corundum-hard transparent oxide film with which it is coated.
2. Exceptionally high maintained reflectivity.
3. The surface, by treatment, can be made reflecting or diffusing to suit the illuminant and the desired distribution.
4. Infinitesimally small loss of efficiency, thanks to its dielectric quality, which repels extraneous matter.
5. Robust in construction, Maxlume Alux can be washed like glass.
6. The high efficiency of Maxlume Alux results in better control of light output—therefore greater utilisation and ultimately savings in capital and running costs.

To indicate the supremacy of Maxlume Alux, here is a comparison of the reflectivity of various materials:

REFLECTIVITY %	WHEN NEW	AFTER ONE YEAR IN INDUSTRIAL ATMOSPHERE
Maxlume Alux	89.7-93.5	89-92.5
Silvered mirror	89.9	86
Vitreous enamel	50-90	*Variable*

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accurate and uniform in both electrical and mechanical properties, wound on special reels for precision winding and enclosed in plastic containers for protection and storage.

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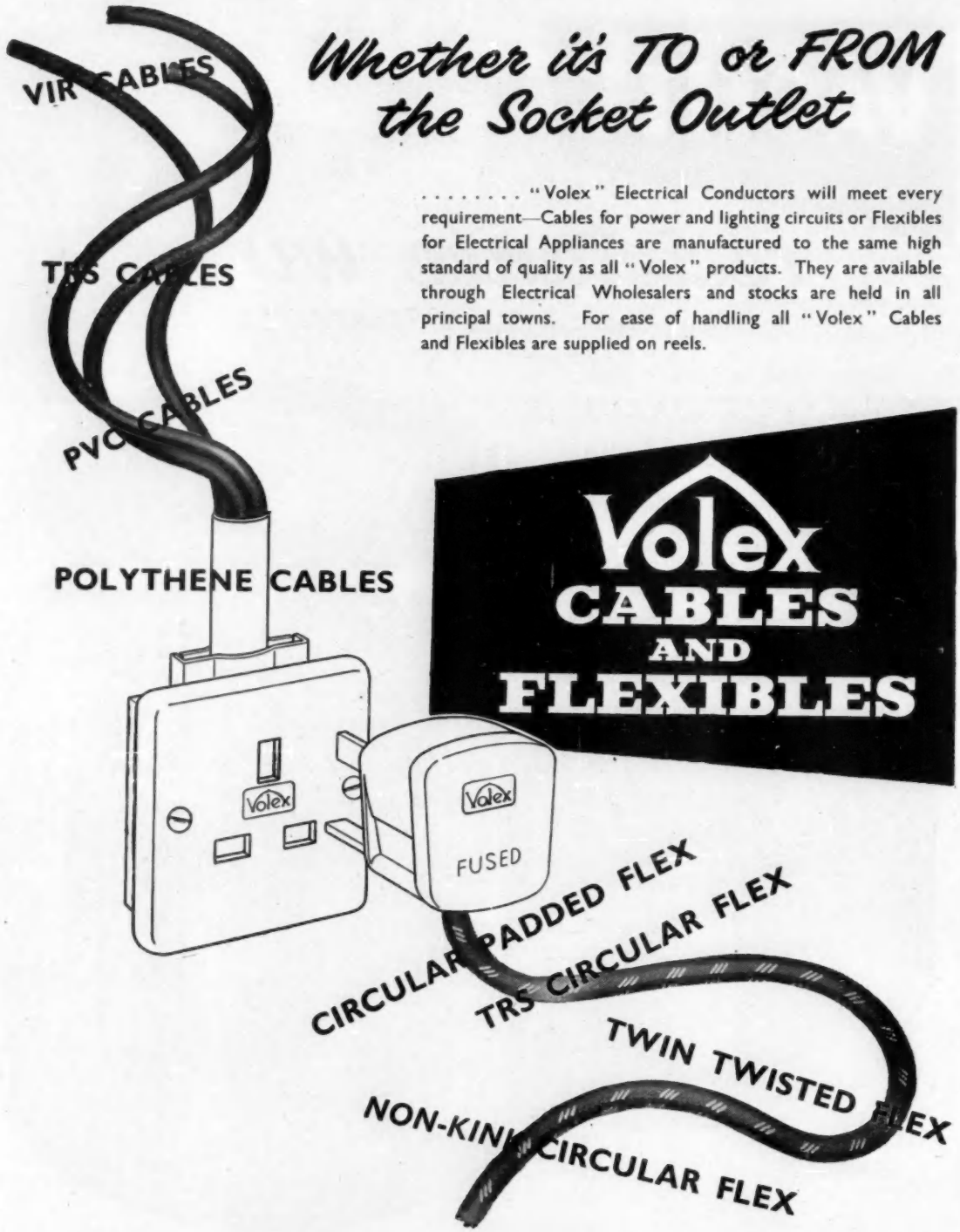

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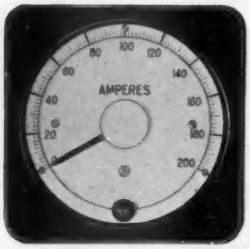

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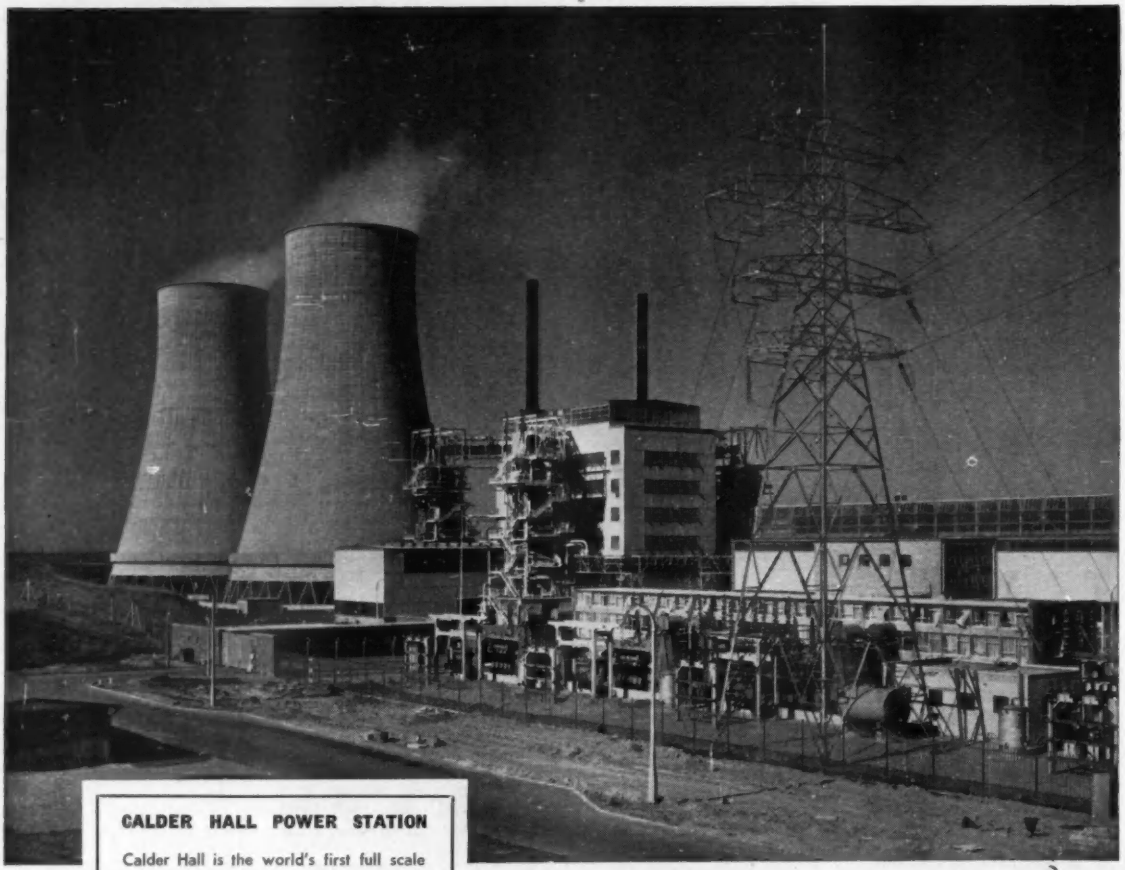

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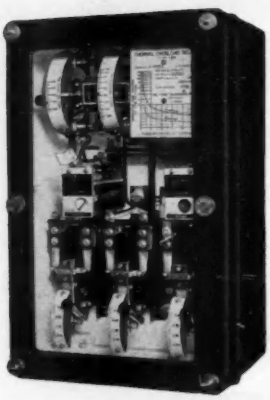

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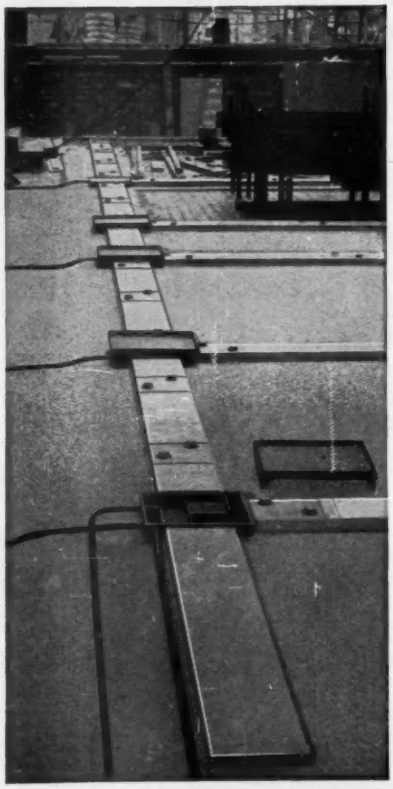

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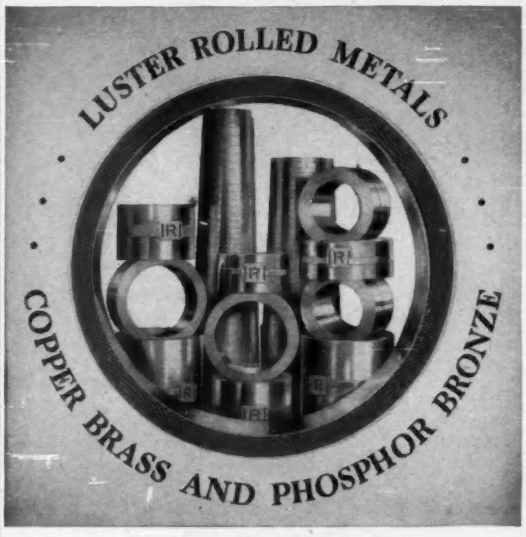

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- **Easily portable (weight 4 lbs.) and can be carried round to every department and plugged into any convenient lighting point so as to determine the number required for the whole factory.**

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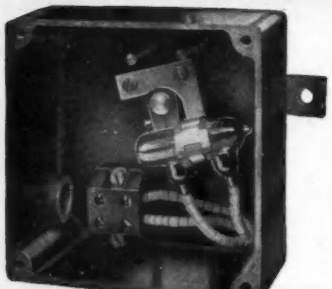

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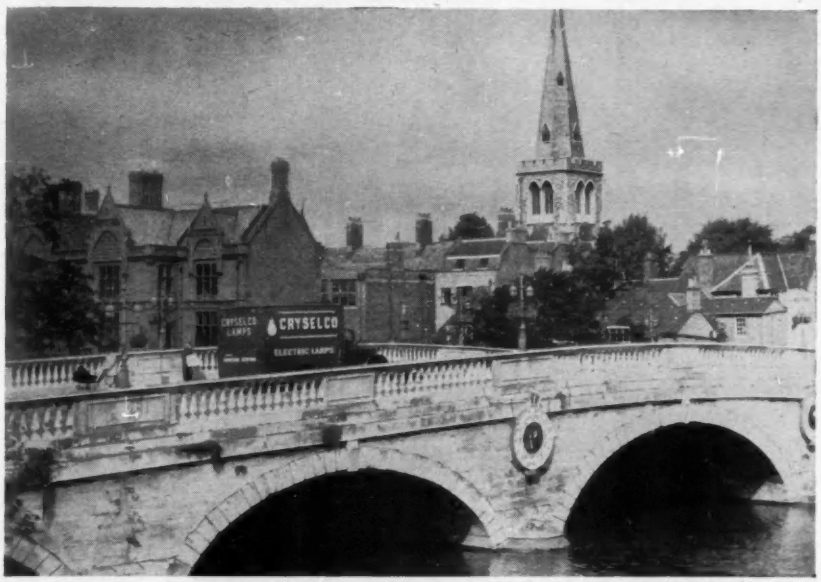

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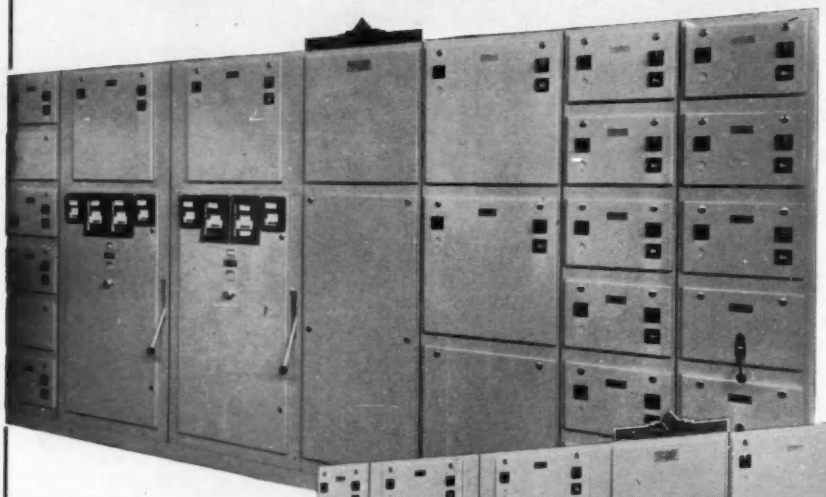

Illustration on left One of several Switchboards embracing Contactor Starters, O.C.B.'s and Switch Fuses in service in Cuba.

Illustration on right shows one of the oil circuit breakers isolated and withdrawn and incoming cabling door removed.

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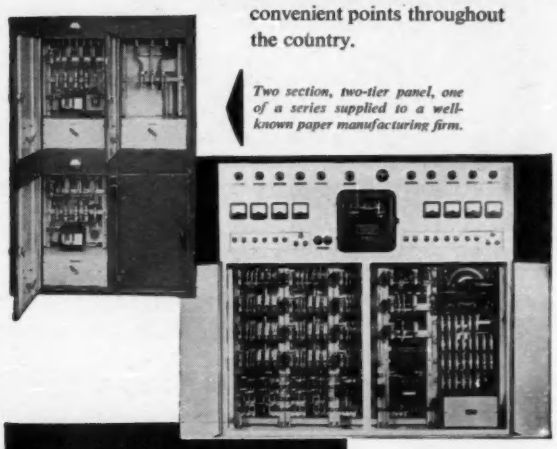
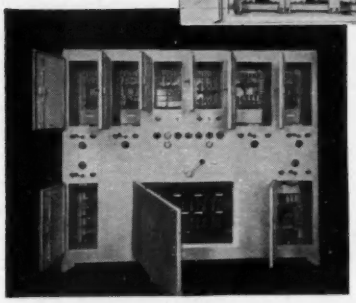


Two section, two-tier panel, one of a series supplied to a well-known paper manufacturing firm.



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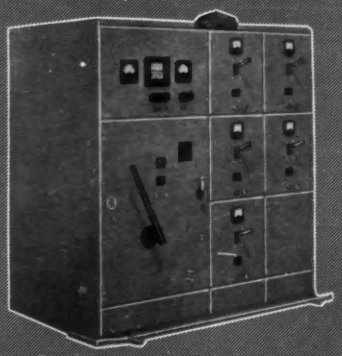
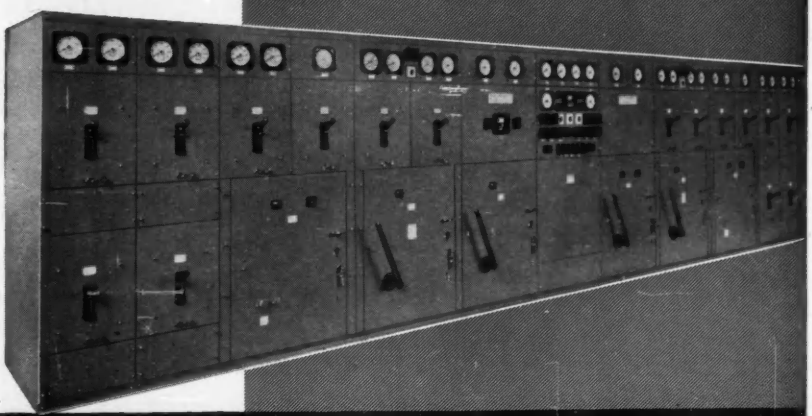


A fine example of an **A/C BOARD** constructed for a large steelworks in this country.

The above photograph shows in some detail an **A/C INDUSTRIAL TYPE SWITCHBOARD** supplied to a large tyre manufacturer.

A D/C CUBICLE TYPE SWITCHBOARD equipped with withdrawable D/C breakers, as supplied to Harbour Boards, Steelworks and Atomic Power Stations.



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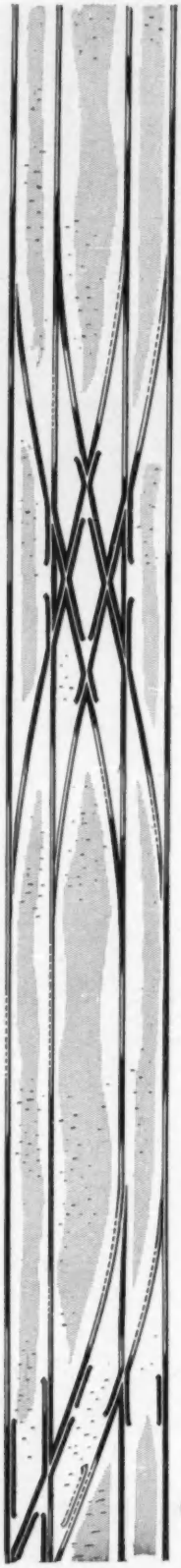

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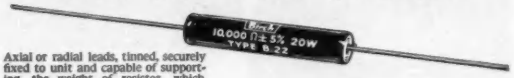

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to generate 240,000 lb of steam per hour at 3,300 p.s.i.
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This is the first Benson-type boiler to be built in
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It will convert the whole of the ash and the dust
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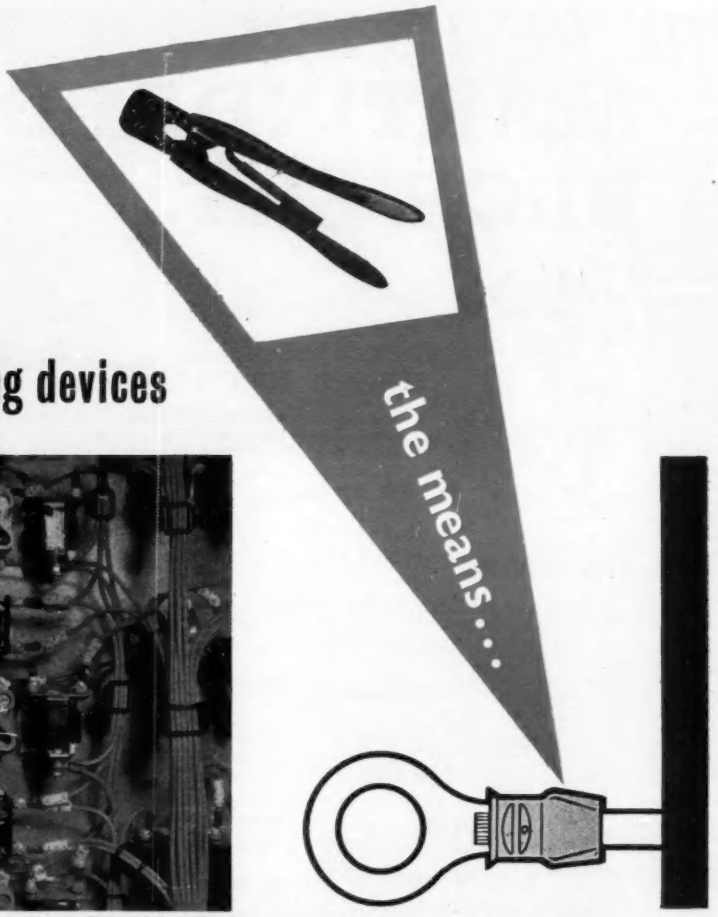
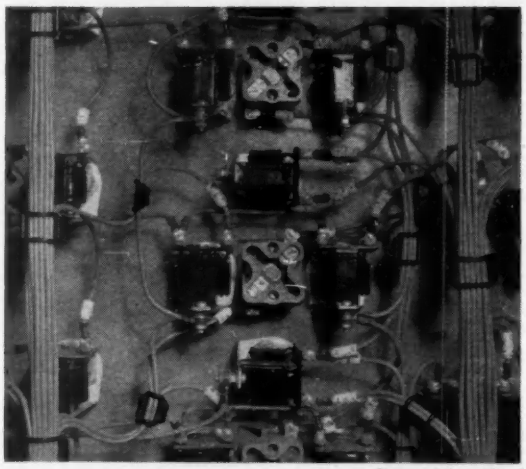
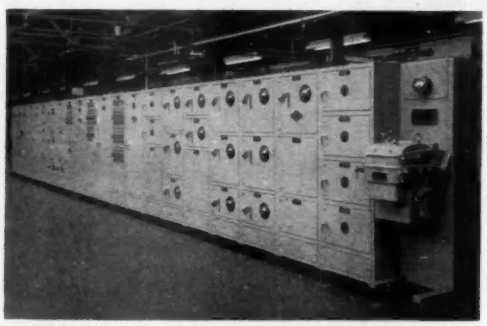




Close-up of Control Panel sub-assembly, illustrating the use of Pre-Insulated Diamond Gripring Tongue Terminals



Automation Control Panel built by Igranic Electric Company Limited for the Ford Motor Company Limited, Dagenham

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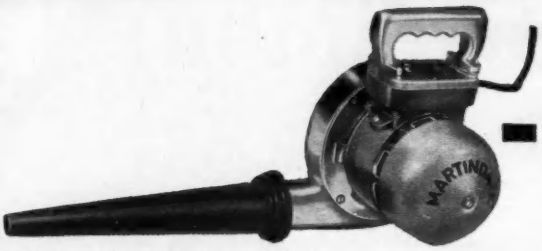

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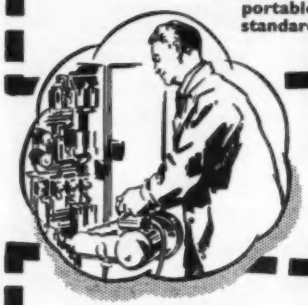
All of the five blowers are instantly converted into portable industrial suction cleaners by the use of standard attachments at little cost.



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An independent Heater is available for attachment to the Blowers, which produces hot air for the quick drying of coils, transformers and for many other purposes.

THE "PORT-A-VAC" (regd.)

The "Port-A-Vac" (regd.) light-weight harness permits the Martindale Blower to be used as a powerful vacuum cleaner carried in comfort upon the operator's back leaving him free to climb ladders, etc., to clean out-of-reach parts of the factory.

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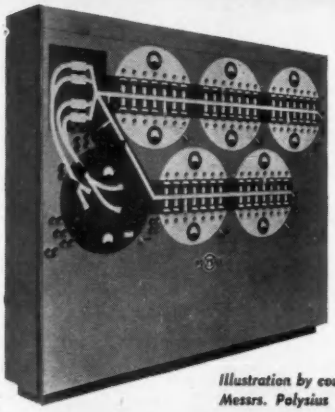

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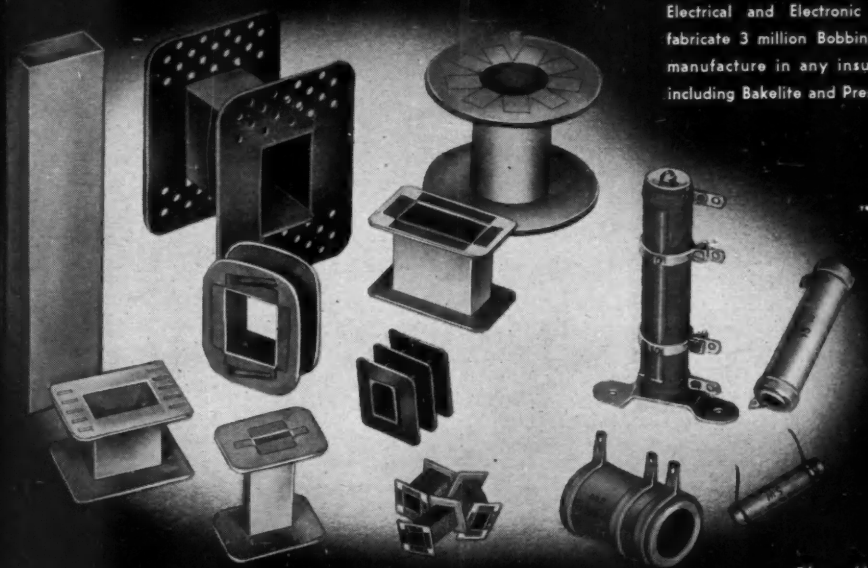

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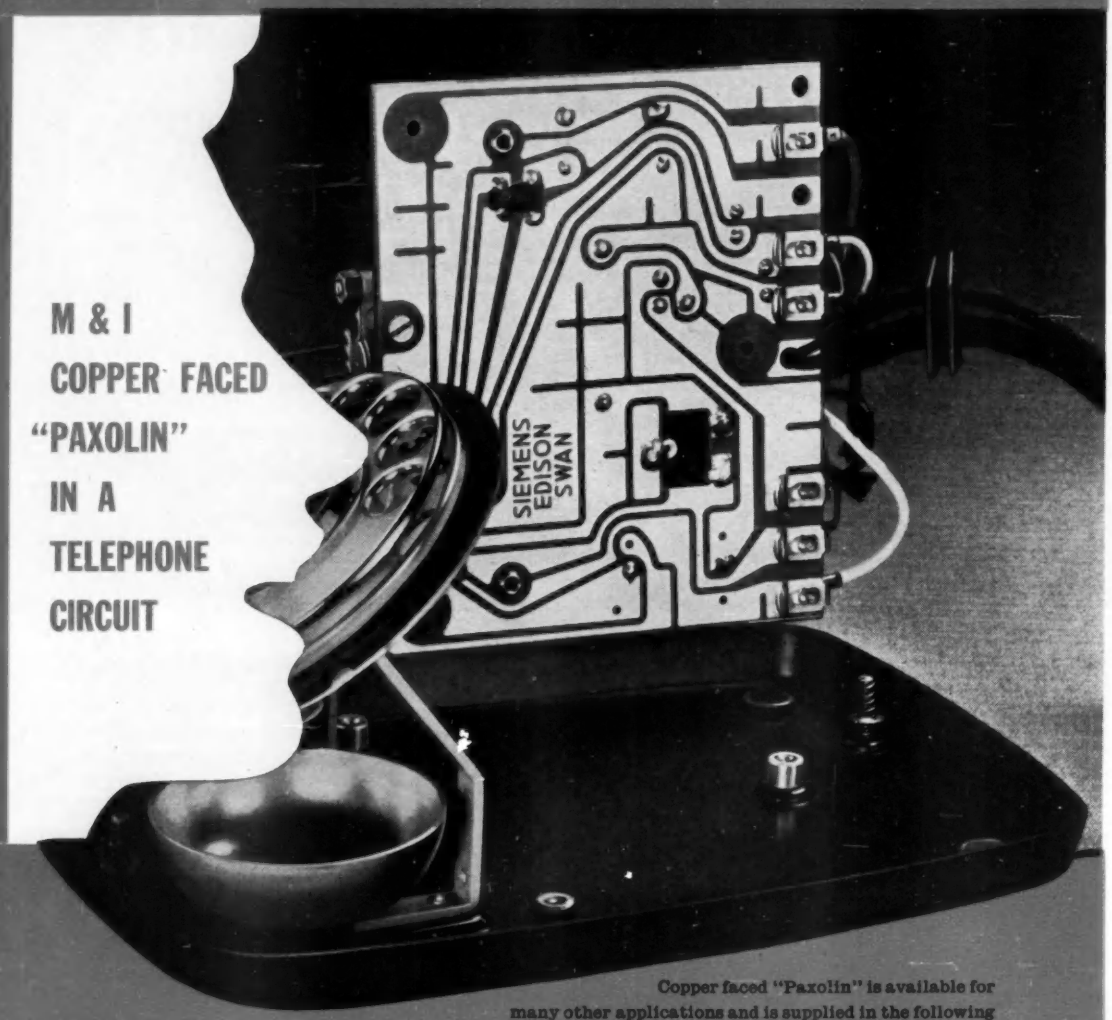

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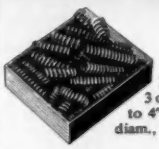

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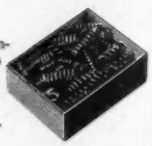

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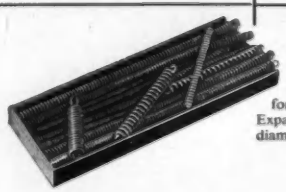

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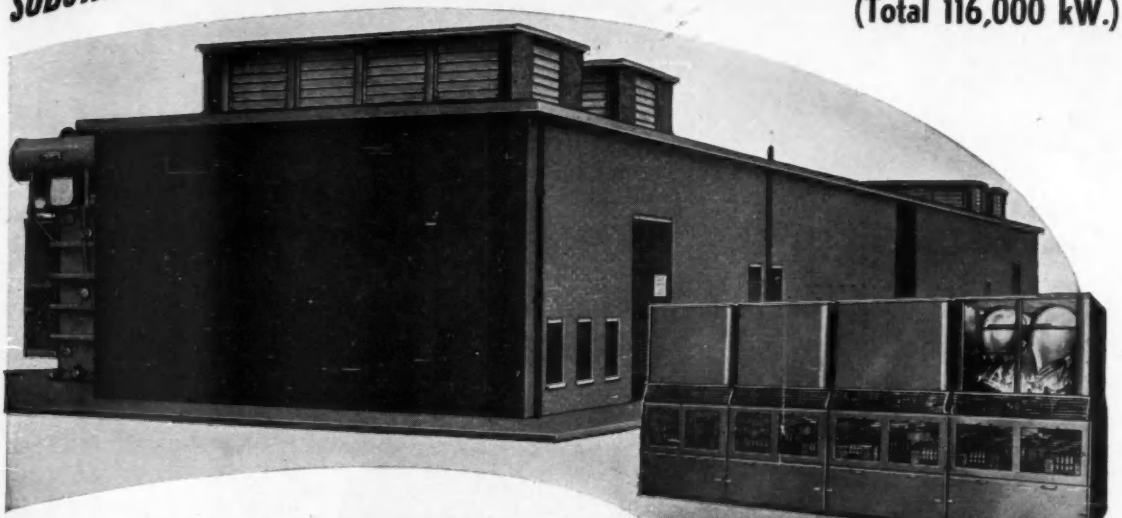
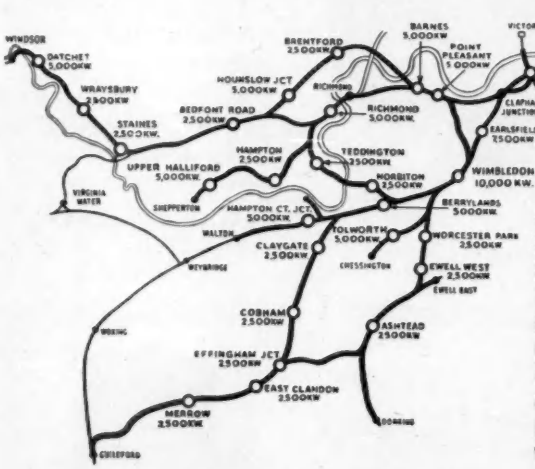


Illustrated: the 10,000 kW. sub-station at Wimbledon and inset, one of the banks of rectifiers installed therein.



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Merrow	2,500 kW.	Earlsfield	7,500 kW.
East Clandon	2,500 kW.	Point Pleasant	5,000 kW.
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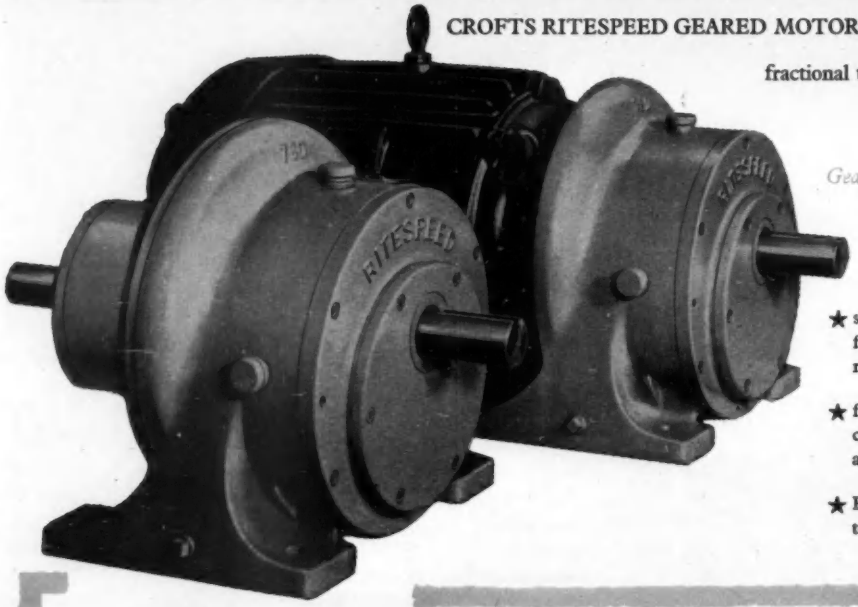

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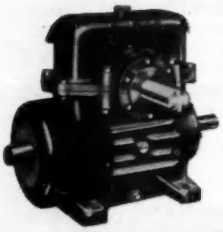

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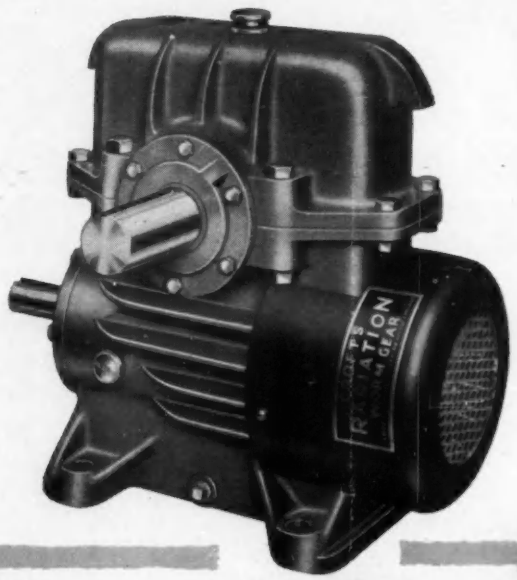

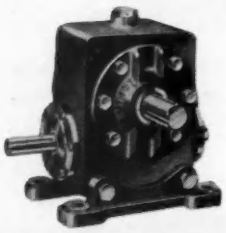

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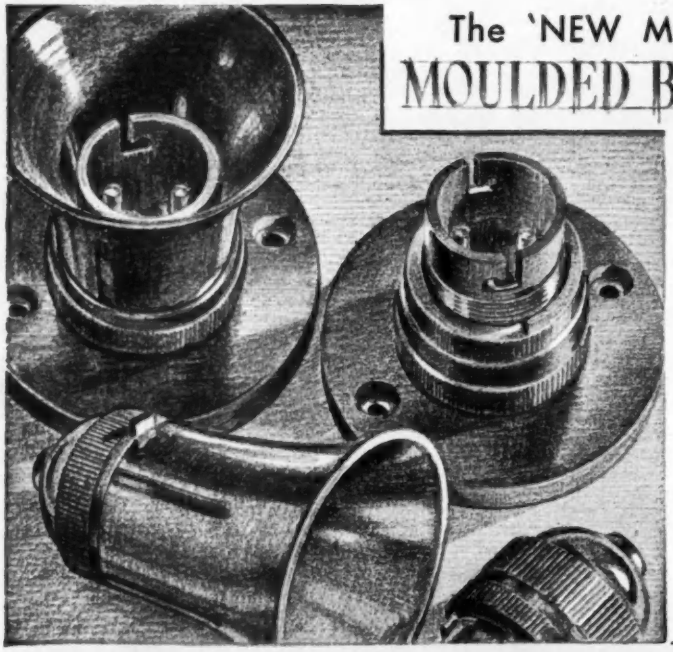

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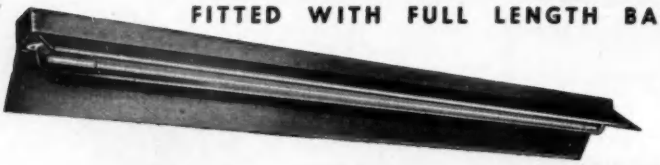

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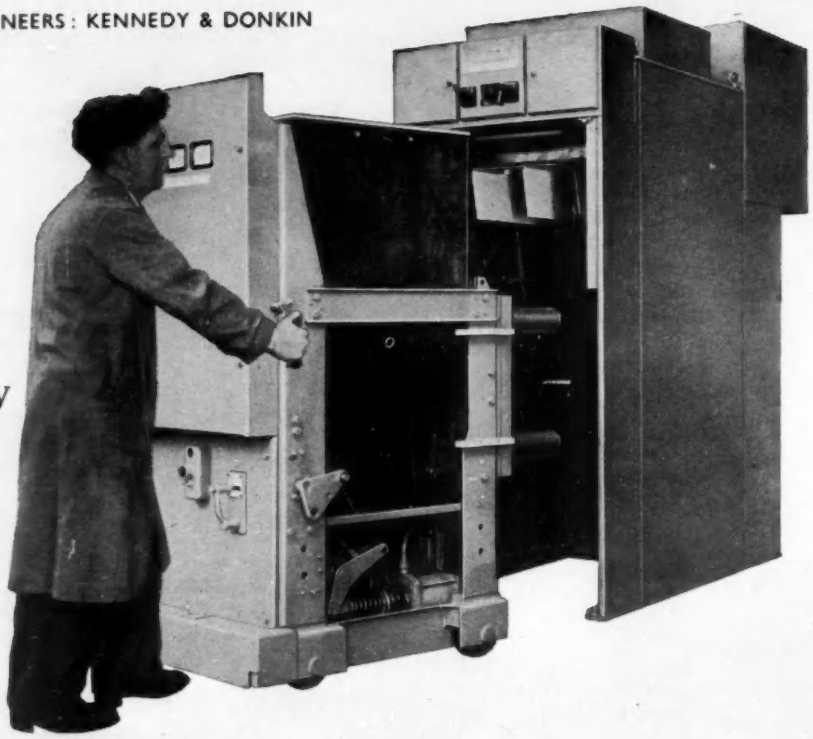

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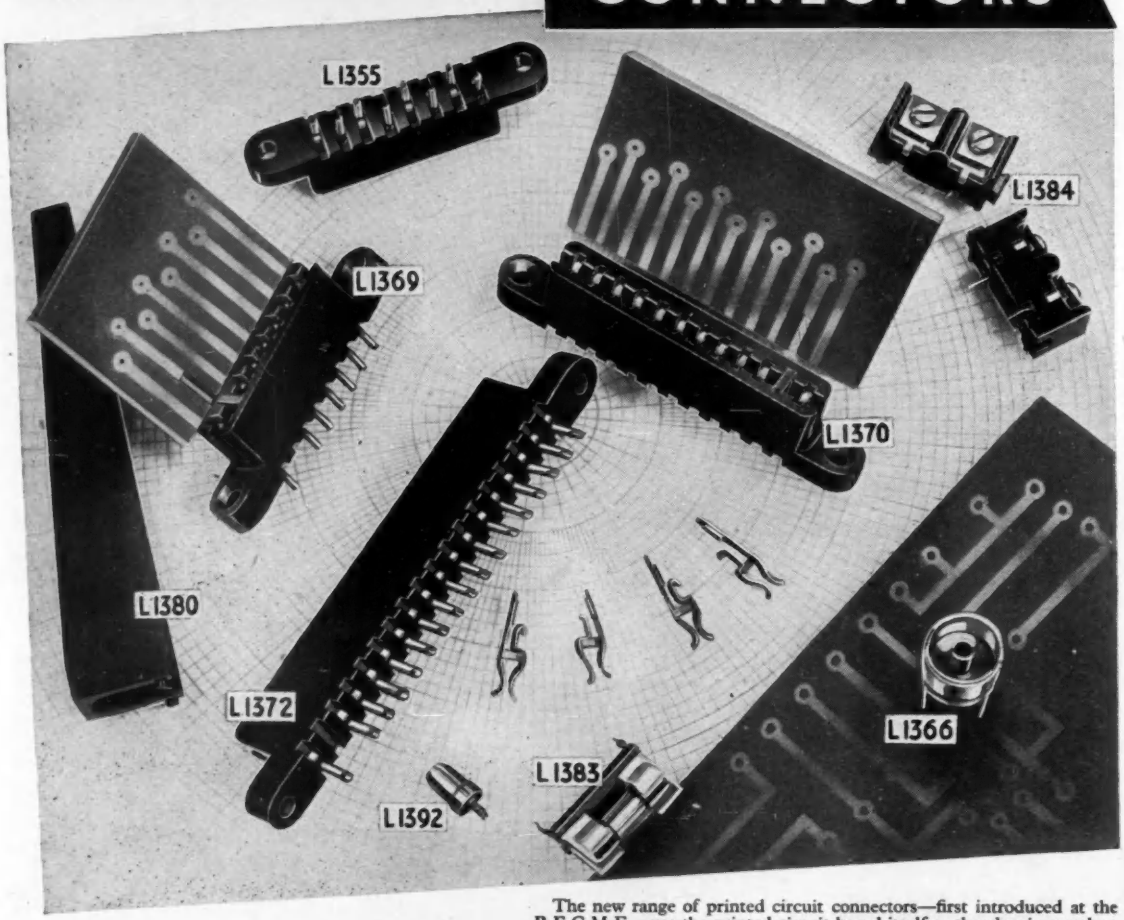

L.1369	8-pole connector 0.15" module
L.1370	12-pole connector 0.15" module
L.1372	18-pole connector 0.15" module
L.1355	8-pole connector 0.1" module
L.1380	Printed circuit guide
L.1381	Polarizing pin for connectors
L.1366	Coaxial socket (accepts standard plugs)
L.1383	Fuseholder size 00
L.1384	2-way Terminal block (Dovetail type)
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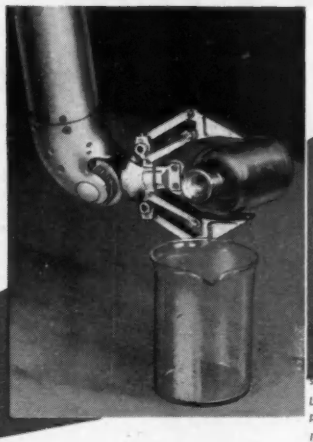

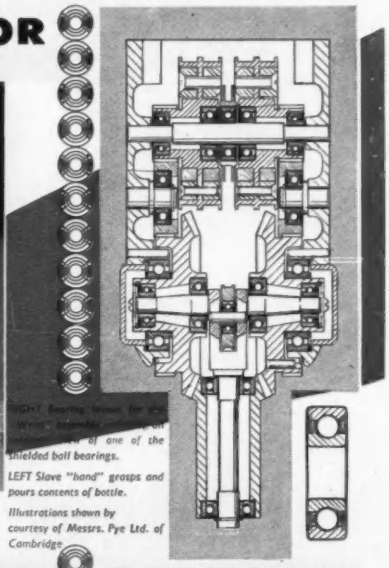

RIGHT Bearing layout for the "wrist" assembly ... of one of the shielded ball bearings.

LEFT Slave "hand" grasps and pours contents of bottle.

Illustrations shown by courtesy of Messrs. Pye Ltd. of Cambridge.

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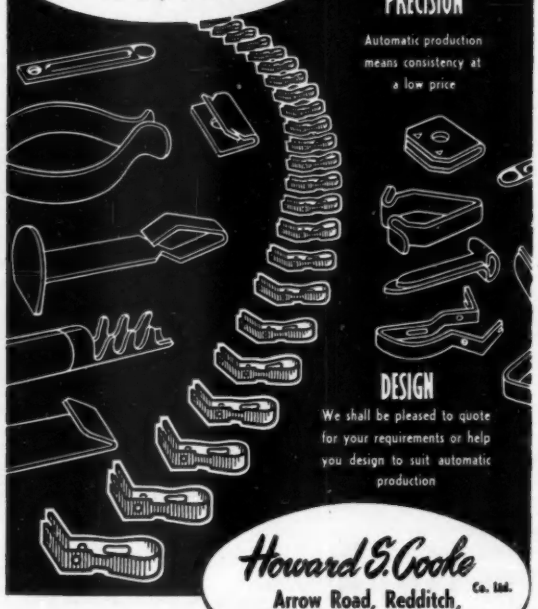

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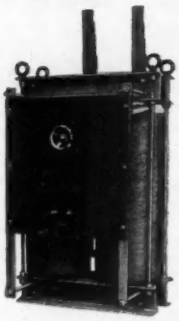

The illustration is of a 60 KVA Transformer with a 5,000 amp. Secondary, with tapped Primary to give secondary voltage variation from 12 volts to 4 volts. Primary tap changes are made with a rotary switch as shown. These Units are designed and tested to BSS 171 where applicable, or appropriate B.S. Specification.

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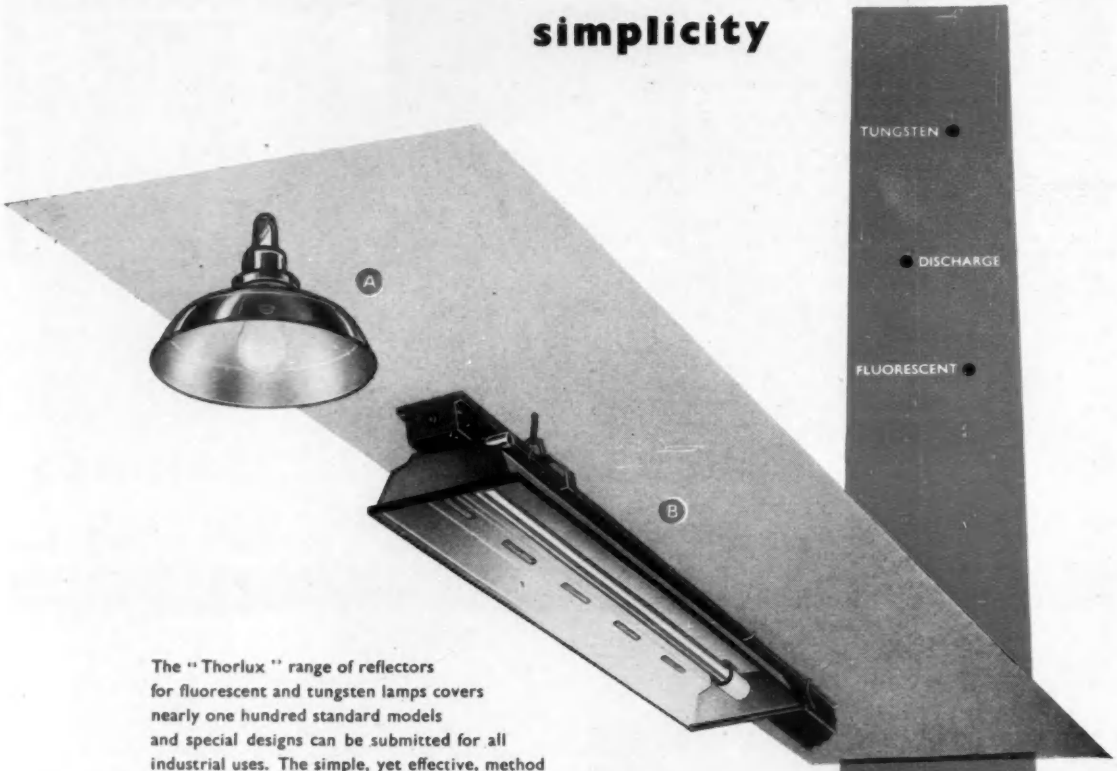

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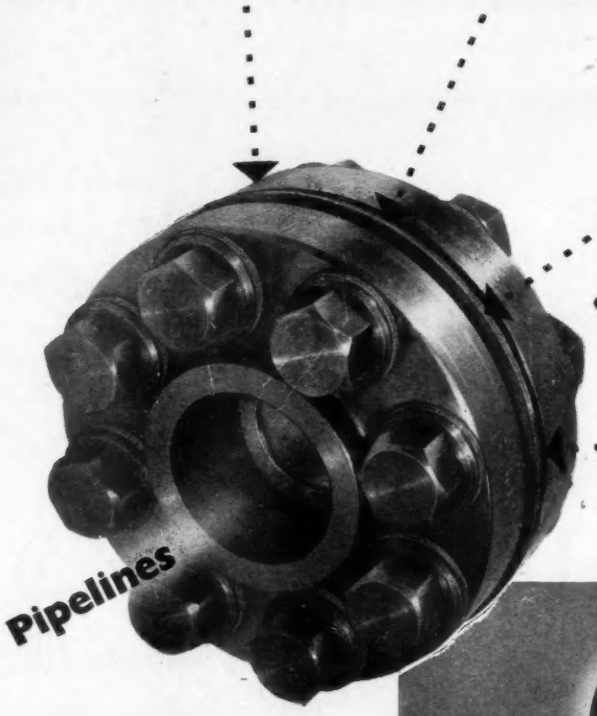

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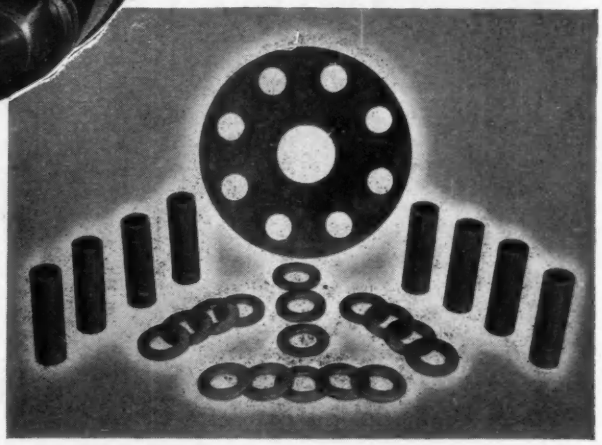

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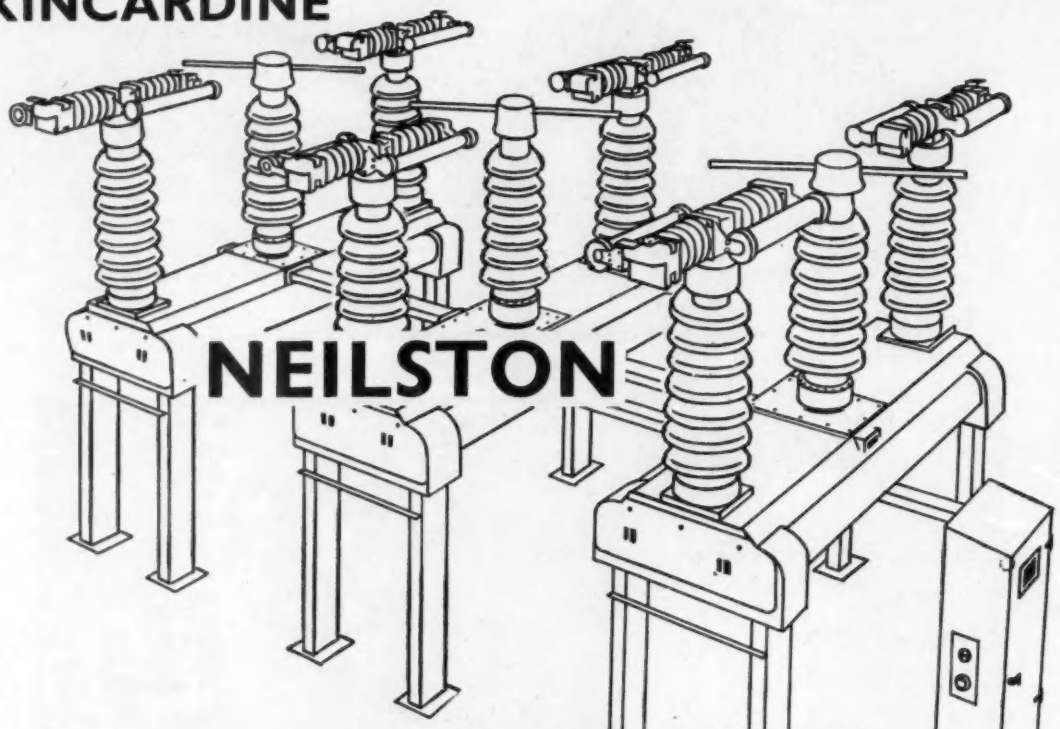

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2 MAY
1958

ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

In This Issue

Ships and Reactors 813 — Possible developments in nuclear power reactors for marine and land purposes are suggested in the annual report of Lloyd's Register of Shipping (see p. 846)

Electric Crane Control 815 — In this issue the author describes the various a.c. control methods. He deals with pole changing, rotor resistance control, hoisting controllers, unbalanced stator-voltage control, braking, etc., and concludes by discussing the relative merits of manual and contactor control

Progress on the Supergrid 821 — A section of the supergrid just erected by Henley's will eventually connect 275 kV substations at Tilbury and Rayleigh; at present it is energised at 132 kV

Overseas Electrical Trade 833 — In the first quarter of the year electrical equipment to the value of £58·3 million was exported, nearly £2 million more than in the corresponding three months of 1957

Kariba Gorge Transmission 840 — The 330 kV transmission system being constructed for the Federal Power Board of Rhodesia is based on the Kariba hydro-electric station which will have a capacity ultimately of 1,200 MW

Monitoring Loudspeakers 842 — The author, who is with the B.B.C. Research Department, expresses the opinion that future high-quality loudspeakers will, in general, be much less directional than at present

Manufacturing Progress in 1957—Ferranti, Ltd. 845 — A million volt testing transformer supplied to the National Physical Laboratory is believed to be the largest outdoor unit of its kind in the country. Production of large power transformers for both home and overseas has been well maintained

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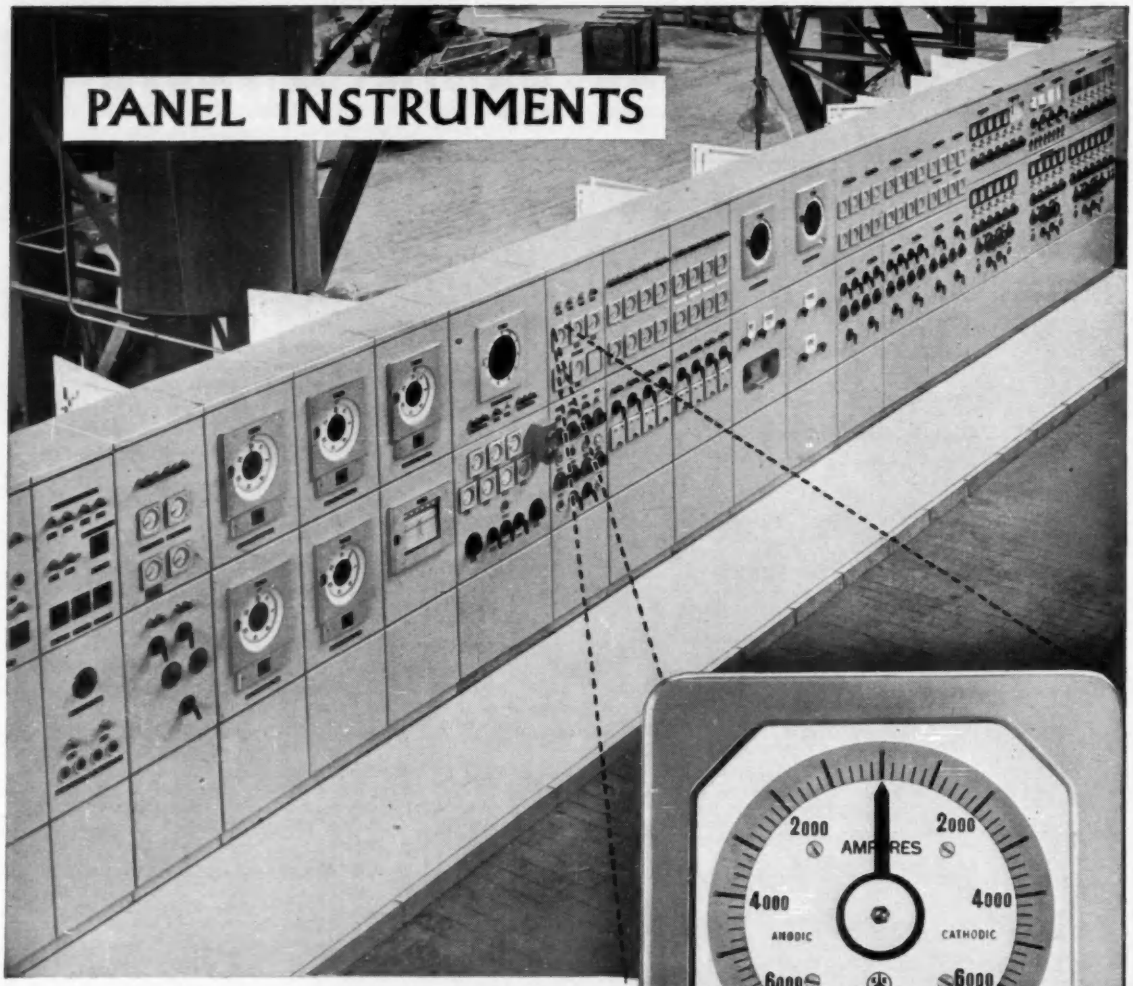
PANEL INSTRUMENTS



Hot rolled strip steel from Abbey Works is cold rolled, degreased and annealed before entering the tinning lines at Velindre. These lines were specially developed to economise in tin, yet ensure accurate plating of coils of steel up to 7 miles long, and weighing 15 tons.

The illustration above (photographed in the course of installation) shows the control station for the whole line. This control station was constructed at the Chippenham Works of Westinghouse Brake and Signal Co. Ltd. and accurately controls the output from banks of Westinghouse water-cooled rectifiers, enabling some 3,000 tons of finished tin-plate to be produced each week.

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A very large number of Everett Edgcumbe instruments have been used on various control boards installed at the Velindre Works of the Steel Company of Wales. The one illustrated is typical and is a 4 in. flush type with internally illuminated platform scale.

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ELECTRICAL REVIEW

2 May 1958 Vol. 162 No. 18 Established 1872

Ships and Reactors

LLOYD'S Register of Shipping operates in a wider field than its name implies. As its 1957 report says, it exists to give a service to shipping, and this term includes shipowners, shipbuilders, engineers, steelmakers and the many ancillary works connected with them, as well as underwriters. Consequently the Society employs well over a thousand ship, engineering and other specialist surveyors all over the world and its activities reach out in a number of directions.

The Society is naturally interested in the proposals for ship propulsion by means of nuclear reactors and the report surveys progress in this field. The conclusion is arrived at that " nuclear " merchant ships of conventional size are unlikely to be competitive for several years. But this opinion seems to be based on American experience with sodium-type and pressurised-water reactors; in this country faith continues to be pinned largely to the " Calder Hall " type of an advanced design.

From marine nuclear power the Society's interests extend to nuclear power stations on land, those interests lying mainly in the pressure vessels. There must eventually be a limit, it is said, to the size and shell thickness of a normal carbon steel reactor vessel—if that limit has not already been reached—and possible alternatives are discussed. The report mentions a French steel-lined pre-stressed concrete shell. Another possibility is the use of higher pressures and temperatures with the same, or an even smaller, vessel. But this would necessitate an improved type of fuel element and either creep-resisting higher tensile steel for the shell, to reduce thickness, or higher tensile steel with internal shielding to keep shell temperatures below the level at which creep becomes a problem.

Sir John Cockcroft in his recent James Forrest Lecture spoke of a project for improved fuel elements. He mentioned the possibility of an advanced gas-cooled reactor (" A.G.R.") which might reduce the capital cost by as much as 30 per cent by increasing the surface temperature of the fuel elements to about 600 deg C; uranium metal fuel would be replaced by a sintered uranium oxide fuel element. Sir John also referred to research being carried out by the Atomic Energy Authority for the development of impervious ceramic sheathing for a ceramic fuel element which was a mixture of graphite, uranium and thorium. If this were successful, he said, this reactor might have applications to propulsion.

This brings us back to ships. Although it seems probable that marine nuclear propulsion will be by direct turbine, rather than turbo-electric, drive, we naturally hope that the more flexible system will be fully considered. But in any event endeavours to evolve a more compact and less costly reactor for marine propulsion must have its reflection on nuclear power station design.

RAILWAY ELECTRIFICATION

The story, published elsewhere in this issue, of the demonstration run from London to Norwich and back when a normal-sized main-line train was hauled by a new 2,000 h.p. diesel-electric locomotive is an indication that the railway modernisation plan is now well under way. Particular emphasis is placed on this by the announcement that by the end of this year there will be sufficient of these locomotives running to enable all the principal expresses between Norwich and London to be so hauled.

We must, of course, stress that the introduction of diesel and diesel-electric locomotives is only a step towards main-line electrification; all the same, diesel-electric locomotives have some good points. For instance, it is said that removal of the complete power unit is a comparatively simple operation at times of major overhaul. The value of not having to dismantle the unit on the locomotive must be of outstanding importance from the maintenance point of view. Again, the wide speed range of the diesel engine between the limits of 450 and 850 r.p.m. points to outstanding flexibility, as does the automatic adjustment of the loading so that the engine delivers the maximum power corresponding to the selected engine speed.

ELECTRIC CRANE CONTROL

The article by Mr. Broughton in this issue on "Electric Crane Control" as applied to alternating current systems, following as it does closely upon an article by the same author on d.c. electric crane control systems, raises again the very old topic of a.c. *versus* d.c. We are not anxious to take sides in such a controversial subject as this, but we have noticed that in many cases nowadays, perhaps particularly in connection with new or modernised steelworks, the d.c. electric crane is given preference because it is claimed to give better variable-speed performance for hoisting, traversing and longitudinal running. It has often been said that lower capital cost is responsible for this selection, but that can hardly be so, we think, where Ward-Leonard control is used, as is often the case, because the overall cost is hardly likely to be lower where a special motor-generator set has to be provided to serve the drives.

FARADAY HOUSE DEVELOPMENT

Probably the chief claim to fame of the Faraday House Engineering College is its pioneer work in the "sandwich" system of engineering education. The College has been running since 1889 and has provided the electrical industry with many hundreds of engineers with sound theoretical and practical training. Now, after nearly seventy years, it has been thought desirable to reorganise the institution to enable it better to meet modern requirements.

While it will still be the aim to produce electrical technologists, the College's activities will be extended in the mechanical and physical fields. It seems to us that in the course of reorganisation attention could be given to providing for that other badly needed class of men—the technicians. Faraday House methods could certainly be adapted to the production of men "able to apply in a responsible manner proven techniques which are commonly understood by those who are expert in a branch of engineering, or those techniques specially prescribed by professional engineers."

A new board of governors has been appointed and, as will be seen from the list published in last week's issue, it consists of a number of eminent and influential men representing many facets of the electrical profession and industry. This is a guarantee that the revised arrangements will be soundly and efficiently based.

SELLING SPACE HEATING

We have come a long way from the days when the use of electricity for space heating, particularly in the home, was widely considered as contrary to the national interest. The 1955 Sample Survey of Domestic Consumers revealed that 60 per cent of all consumers had at least one electric space heater, and last year, despite the continuing high level of purchase tax, production of these appliances increased by nearly half a million to 2,461,000. There has also been a growing enthusiasm for block storage heaters, at present restricted to non-domestic premises, and for electric floor warming. With these two systems electricity has now become a serious competitor to conventional methods of central heating.

In view of this it is discouraging to read in Mr. Gilchrist's paper presented at the recent E.D.A. Sales Conference that some Electricity Boards still do not encourage domestic heating, from the fear that it will contribute unduly to the chargeable peak demand. There has, as he remarks, been a tendency for the electrical industry to be excessively selective in the loads it accepts rather than adjusting tariffs and designing networks so that all forms of heating are acceptable economically and technically. Electric space heaters have a high diversity and, as the price of other fuels continues to rise more rapidly than that of electricity, they will tend to be used for longer periods, thereby improving their load factor. There would, therefore, seem to be much to support Mr. Gilchrist's view that when direct electric space heaters are used to supplement other forms of heating, both electrical and solid fuel, this load can be developed without seriously embarrassing either the generating plant or the distribution systems. The aim should be a satisfactory combination of direct and off-peak electric heating in an all-electric home.

MECHANICAL HANDLING EXHIBITION

From Wednesday next until 17th May the sixth biennial Mechanical Handling Exhibition is being held at Earls Court, London, and for the first time it will be international in character. Next week's issue of the *Electrical Review* will contain an illustrated review of the wide variety of electrical equipment being shown at the Exhibition

Electric Crane Control

2.—ALTERNATING CURRENT SYSTEMS

By H. H. BROUGHTON,
M.I.C.E., M.I.Mech.E., M.I.E.E.

ON 11th April d.c. control systems for electric cranes were dealt with and now consideration will be given to a.c. systems. Crane users who prefer d.c. to a.c. operation find it convenient to obtain a supply from one or more substations energised from the a.c. network, and the recent introduction of high-efficiency rectifier units will enable them to continue to derive the benefits of the control systems which they favour, without sacrificing the advantages of a.c. transmission. Standardisation of high-voltage three-phase power transmission, coupled with ease of transformation for industrial purposes, has led to the increasing use of a.c. as a motive power for cranes and in numerous instances this has given rise to dissatisfaction on the part of those who have expected performance comparable to that obtained with d.c. cranes.

The complaint regarding low hoisting and lowering speeds, particularly when light loads are suspended from long ropes, is well founded because if the motion is driven by an induction motor the maximum hoisting speed of

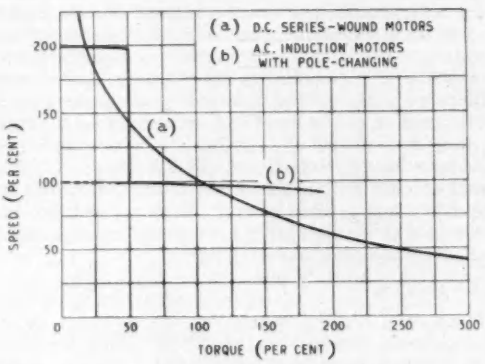


Fig. 12

an a.c. crane is independent of the load, whereas with a d.c. series-wound motor the load on the hook automatically determines the speed. Thus, if a three-ton d.c. wharf crane is geared for a full-load hoisting speed of 240 ft/min, the speed will be about 330 ft/min with a 1½-ton load, and with an empty hook will increase to 480 ft/min. A similar a.c. crane hoists at 240 ft/min, irrespective of the load, and under variable loads the tonnage output is likely to be about 75 per cent of that of the d.c. crane. When a.c. overhead cranes operate on long runways the travelling motions are affected in the same manner.

It will be shown that objection to low-speed a.c. operation of hoisting motions operating with light loads can be overcome in a number of ways amongst which are: (*a*) load discriminating pole-changing; (*b*) load discriminating using two motors; and (*c*) variable-voltage control of a d.c. motor supplied from a high-speed squirrel-cage a.c. motor-generator on the crane. All these give increased speed with reduced load, and a 2 to 1 ratio is usually sufficient. The full speed a.c. hoisting characteristic modified by pole-changing is shown superimposed on the d.c. curve in Fig. 12. Departure from the normal a.c. drive is seldom necessary for the other motions of a wharf crane because the loads on these, although not constant, usually vary less widely than those experienced in hoisting, and the travelling motion is infrequently operated.

Pole-Changing

The speed of an induction motor is inversely proportional to the number of poles on the stator and speed control by means of a two-speed a.c. induction motor in conjunction with electrically-controlled mechanical braking, or d.c. injection braking, is a promising development which shows to advantage when applied to hoisting motions in so far as it gives the high-speed light-load characteristic which is an inherent feature of a motion driven by a d.c. series-wound motor.

As developed by the B.T.H. Co., Ltd., the stator winding is provided with a simple change of connections to give a 2 to 1 change-pole feature, and the rotor has two independent windings. Of these, the main winding corresponds with the larger number of poles on the stator and is connected to sliprings. Under this condition the motor operates as a normal slipring machine with rotor resistance, and electrically-controlled mechanical (load) braking is incorporated to give low-speed operation. The second rotor winding, arranged to correspond with the lower number of poles on the stator and short-circuited, acts like a squirrel-cage winding when the stator is connected to produce the lower number of poles but is ineffective with the stator connected otherwise.

The control circuits are such that when the load exceeds about 25 per cent of full load a relay, actuated by the rotor current, trips to prevent the motor from being connected for high-speed operation. For all loads less than 25 per cent the last notch of the controller becomes effective in changing the stator connections to give twice the normal full-load hoisting speed. On the lowering side, if the load exceeds 25 per cent, super-synchronous speeds, limited to 150 per cent, are obtained by rotor-resistance control and regenerative braking. If, however, the load is less than 25 per cent a relay, responsive to rotor current, permits the stator to be connected for high speed and the light hook can be driven down at twice the normal full-load hoisting speed.

Rotor-Resistance Control

This method of control, modified if necessary to suit the requirements of the drive, is applicable to all crane motions. Like the d.c. shunt motor an induction motor is essentially a constant-speed machine and to reduce the speed it is necessary to increase the resistance of the rotor circuit. The effect of so doing is shown by the speed-torque characteristics, Fig. 13, which have been plotted from the basic torque equation given in the diagram, for normal voltage supply, with several different rotor resistances and for speeds ranging from −100 to +200 per cent. The corresponding values of slip are +200 and −100 per cent, which means that, in addition to

normal running, regenerative and counter-torque braking conditions are included. It will be seen that:—

(1) The maximum torque which can be developed by a given motor is independent of the rotor resistance and of the (variable) nameplate rating.

(2) The torque is negative when the slip is negative, that is when the speed of the motor is greater than synchronous speed which is that of the rotating field. Under these conditions the machine operates as a generator and returns energy to the supply.

(3) No matter how great the slip, as long as it is positive, the torque is positive. Hence, if the slip is greater than 100 per cent, as it is when the direction of the rotating field is reversed with the motor still running, the torque

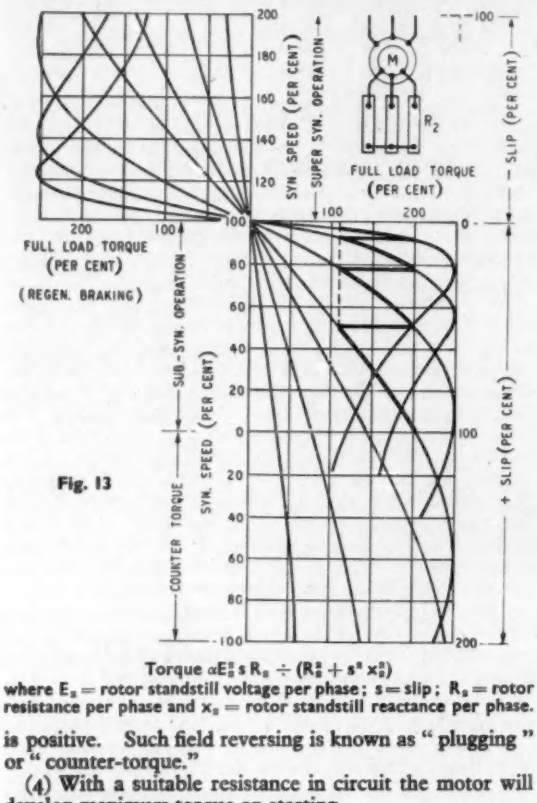


Fig. 13

Torque $\propto E_2^2 s R_2 \div (R_2^2 + s^2 x_2^2)$

where E_2 = rotor standstill voltage per phase; s = slip; R_2 = rotor resistance per phase and x_2 = rotor standstill reactance per phase.

is positive. Such field reversing is known as "plugging" or "counter-torque."

(4) With a suitable resistance in circuit the motor will develop maximum torque on starting.

Since torque is proportional to the square of the rotor voltage it follows that if the supply voltage is, say, 90 per cent, the torque will be approximately 81 per cent of that developed when normal voltage is applied to the stator. Hence, the maximum of 250 per cent shown in Fig. 13, and known as the "pull-out" value, will be reduced to 202 per cent. This reduction has a marked influence on the starting performance because the permissible torque rating, deduced from the nameplate rating and expressed on a short-time or load factor basis, is variable as also is the pull-out ratio which is defined as pull-out torque ÷ rated torque. Table 2 shows the effect of load factor rating and voltage drop on the pull-out ratio of a typical a.c. crane motor. The ratios, which are given for normal supply voltage and for a 10 per cent voltage drop, vary from 1·6 and 3·2.

TABLE 2.—RELATION BETWEEN LOAD FACTOR AND PULL-OUT RATIO

Load factor %	Rated H.P.	Pull-out ratio	
		Normal voltage	10% drop
20	27	2·0	1·6
40	22	2·5	2·1
60	17	3·2	2·6

Under an average torque of 150 per cent the starting conditions are indicated by the saw-tooth curve in Fig. 13 and, since a minimum pull-out ratio of 2·2 is requisite, it is evident that motors rated on a low load factor or short-time basis cannot be relied upon to develop torque sufficient for rapid acceleration when supply voltages are sub-normal.

Hoisting Controllers

Hoisting control requirements were summarised in the first section of this article and a diagram, Fig. 2, was given which illustrated in a simple manner the characteristics of such control. It is now necessary to consider several of the principal a.c. systems in use and to refer to a number of modifications in course of development.

Reference to the left-hand portion of Fig. 13 shows that when a load is being lowered by an induction motor without external resistance in the rotor circuit a constant speed slightly higher than 100 per cent is attained. Under these conditions the machine operates as an a.c. generator without change of connections and the electrical energy returned to the supply gives rise to regenerative braking which persists as long as the conditions remain unaltered. Augmenting the rotor resistance results in the braking effect being maintained but at increased speed. In both cases braking is dependent on overspeeding and although a maximum speed of 150 per cent is sometimes allowed with full load it is preferable not to exceed 125 per cent.

Since with this method, irrespective of the load on the hook, speed cannot be less than 100 per cent, other means of speed control and of arresting the motion have to be provided, amongst which are the following:—(1) Load brakes, mechanically or electrically controlled; (2) counter-torque braking; (3) d.c. dynamic braking; (4) unbalanced stator voltage control; (5) a.c. dynamic braking; and (6) load-controlled unbalanced voltages.

Load Brakes

Mechanical braking systems of various kinds, in conjunction with standard reversing controllers, are widely used, particularly on small cranes which are infrequently operated. When lowering is in progress the motor drives against a brake and the arrangement is such that the braking torque is proportional to the load on the crane hook. Shoe brakes are preferable to the multiple-disc (Weston) type and it is desirable that the rotor resistances should be rated on the assumption that the load factor is not less than one-third. Apart from heavy wear of the brake linings and possibility of overheating, which are common to all mechanical systems, further disadvantages are that the brake is in action throughout the whole of the lowering period, unless a manual release is provided, and is inoperative on all notches during hoisting.

The latter objections do not apply to electrically-controlled mechanical (load) braking systems one of which consists of a spring-loaded thrustor-controlled shoe brake with the thrustor motor connected across the rotor slip-rings of the hoisting motor. When the latter is energised initially, the thrustor lifts the brake shoes clear of the drum thus allowing the motor to start and, as it accelerates, the rotor frequency and speed of the thrustor decrease. This reduces the thrustor pressure and results in a gradual application of the brake. When hoisting is in progress the torque due to the load, friction and braking are balanced against the motor torque at a speed determined

by the characteristics of the several components. During lowering, the creep speed is determined by the balance of friction and braking torque against motor and load torque. Brake operation is seldom required on more than one or two control notches in each direction. On the remaining notches the thrustor is disconnected from the sliprings and connected to the main supply thereby giving normal braking. To ensure complete stability during low-speed operation it is essential that the rotor resistances should be made of material having a negligible temperature coefficient. Known as "Stacreep," this method of braking can be used with drum or contactor controllers.

Counter-Torque Braking

This method is based on reversal of the rotating field while the motor is still running, and is used for retarding travelling and similar motions. When applied to hoisting control, counter-torque, applied in several stages, is best suited for lowering predetermined medium and heavy loads such as in grabbing, but its use for general-purpose cranes is unsatisfactory because the speed regulation is bad with varying torque, light loads cannot be lowered at low speeds, and there is no creeping speed for such loads. Moreover, unless an anti-hoist relay is provided it is possible for false operation to occur if the controller is held on higher torque notches than the the load requires.

Typical counter-torque control characteristics are plotted in Fig. 14. In the hoisting direction rotor-resistance control is provided on all notches. On the lowering side the sequence commences on notch 5L with the stator energised to lower and with the rotor-resistance short circuited. On notch 6L resistance is inserted thus permitting faster lowering of heavy loads. To retard the motion the controller is moved to notch 4L which initiates counter-torque by connecting the stator for hoisting with reduced torque and the latter is increased step-by-step on notches 3L, 2L and 1L by progressively reducing the rotor resistance. Hoisting on all counter-current lowering notches is prevented by an anti-hoist relay which is actuated by a plugging switch mounted on the motor spindle. From the diagram it will be seen that the lowering performance is shown by downward extension of the hoisting curves into Quadrant 4.

D.C. Dynamic Braking

The limitations and deficiencies of mechanical, re-generative and counter-torque braking systems led to re-examination of a method which, although used in early

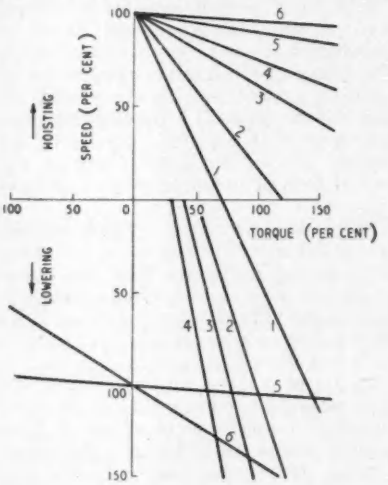


Fig. 14

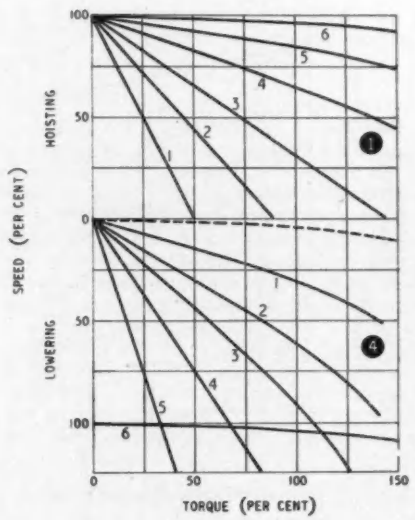


Fig. 15

applications of the induction motor, had been only partially developed. Known as d.c. dynamic braking, or "d.c. injection," the method in various forms is now extensively employed for controlling the lowering speeds of general-purpose and other cranes handling widely-varying loads. It eliminates wasteful consumption of electrical energy and, when an overhauling load is assured, furnishes reliable braking control under all operating conditions with smooth transition from one running notch to another as well as creeping speed regardless of the load.

Lowering is initiated by disconnecting the motor from the supply and, without disturbance of circuits, applying d.c. excitation to two sections of the stator winding, leaving the rotor sliprings connected to the variable resistor used in hoisting. When driven by an overhauling load such a machine operates as an a.c. generator having a stationary field and a polyphase armature. The lowering speed is controlled by varying the rotor resistance and/or stator excitation and, for a given torque, increasing the resistance results in an increase of speed. Either a rectifier or small motor-generator can be used for furnishing the low-wattage low-voltage d.c. supply.

Fig. 15 shows the characteristics of a controller having six rotor-resistance hoisting notches, and five d.c. dynamic braking notches and one regenerative braking notch for lowering. It will be seen that, since they converge at zero speed, the curves on the lowering side are less steep than those obtained with counter-torque braking and between 25 and 100 per cent torque a good selection of lowering speeds can be obtained. On the sixth notch the motor "drives-down" and accelerates rapidly to full speed, thereafter lowering regeneratively at speeds slightly higher than normal.

In recent years this method of control has been modified in order to improve the hoisting and lowering characteristics and to provide higher-speed handling of light loads. Particulars of several of these modifications will now be given. "Revcon" control, due to Laurence, Scott & Electromotors, Ltd., superimposes a braking torque on a motoring torque. The slipring induction motor comprises two electrically separate windings on a common core. One of these windings, known as the "motor system," operates as a normal wound-rotor induction motor with rotor-resistance control; and the other, known as the "brake system," constitutes an induction-type machine with d.c. excitation and variable-rotor resistance.

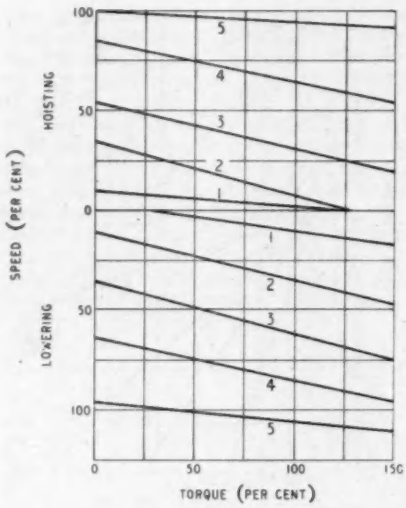


Fig. 16

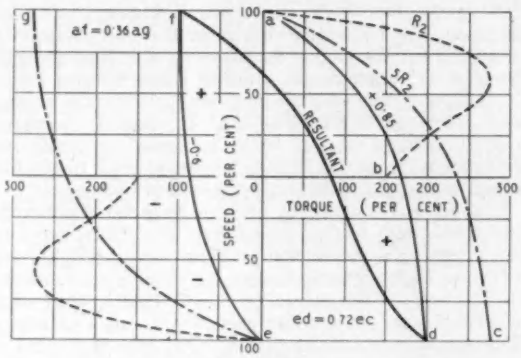


Fig. 17

By varying the rotor resistance of the motor system and the rotor resistance and/or excitation of the brake system, different speed-torque relations are obtained which, in conjunction, give stable no-load speeds. If desired, the control can be arranged so that both systems are available for normal induction motor operation. When pole-changing is used to obtain twice base speed up to half-load with constant h.p. output, an automatic load discriminator is incorporated in the controller. Manual drum control is suitable for motors up to 30 h.p., but contactor control is necessary for larger machines. For small pole-changing equipments a combination of drum and contactor control is available. From the operating characteristics, Fig. 16, it is evident that good speed control at all loads is obtained both in hoisting and lowering.

A system of a.c. hoisting motor control which provides creeping speeds in both directions is being developed by Metropolitan-Vickers. Basically, it consists of two motors, each of approximately 60 per cent of the normal rating required for the motion. In the hoisting direction d.c. injection braking is applied to one motor and power to the other on the first and second notches to give no-load hoisting speeds of 20 and 50 per cent respectively. The remaining three hoisting notches furnish normal rotor-resistance control. On the lowering side variable d.c. injection braking is applied on the first four notches and

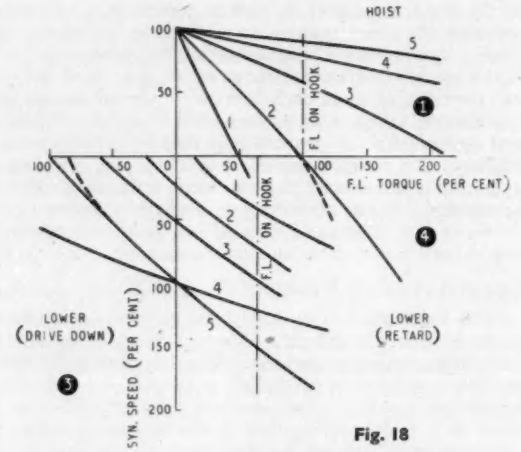


Fig. 18

operation is in Quadrants 3 and 4 thus providing for graded low-speed lowering of all loads. The rotor resistance is cut out on the fifth notch and regenerative braking limits the full-load lowering speed to about 105 per cent. To avoid overstressing of the motor spindle a double-shaft extension on the input shaft of the gear reducer, with a motor on each side, is preferable to a back-to-back arrangement.

In a dual-motor system introduced by Allen West & Co., Ltd., two standard slipring motors are mechanically coupled to a common shaft, the total h.p. output being employed to hoist the maximum load. The larger low-speed motor is controlled by d.c. injection braking, and the smaller high-speed machine is energised separately when light loads are being handled. With this arrangement the characteristics in Quadrants 1, 3 and 4 closely resemble those obtained with d.c. potentiometer control, and give light-hook hoisting and lowering speeds up to 200 per cent normal.

Unbalanced Stator-Voltage Control

Formerly, owing to the excessive heating which resulted from the application of unbalanced voltages to the stator, this method of control was regarded unfavourably; but the search for an a.c. hoisting control system comparable to that of the d.c. potentiometer lowering system led to investigation of the effect of such unbalancing on motor operation and, as a result, several methods of control based on this principle have been introduced. It can be shown that an unbalanced polyphase system is electrically equivalent to two independent balanced voltages one of which gives rise to a rotating field in a clockwise, or positive, direction and the other to a rotating field in a counter-clockwise, or negative, direction. At a given slip the resultant torque developed by the motor is the difference between the torque produced by each of these rotating fields.

It is outside the scope of this article to deal with the theoretical aspects of this method of control but indication can be given as to the manner in which (*a*) the speed-torque curve is derived when a wound-rotor induction motor is operated under unbalanced voltage conditions with external rotor resistance in circuit, and (*b*) the curve is modified when the unbalance is altered.

Referring to Fig. 17, *ab* is the speed-torque curve of a motor with normal balanced voltages applied to the stator terminals and with the rotor short-circuited; and *ac* is the curve with resistance across the sliprings. The motor has a pull-out torque of 275 per cent and with rotor

resistance in circuit maximum torque occurs at point *C* with a speed of −100 per cent. Now suppose that the stator voltages are unbalanced and that, in consequence, the equivalent positive and negative sequence voltages are 85 and 60 per cent respectively. It follows that, since torque is proportional to the square of the applied voltage, the positive sequence torque $=0{\cdot}85^2\times100=72$ per cent and negative sequence torque $=0{\cdot}6^2\times100=36$ per cent. Thus, $ed=0{\cdot}72\ ec$ and $af=0{\cdot}36\ ag$. This suffices for the determination of the speed-torque curves *ad* and *ef*, and by combining the two the resultant characteristic *fd* is obtained. With balanced stator voltages and with rotor resistance $=5\ R_2$ in circuit, the characteristic is *ac*.

By modifying the unbalanced voltages applied to the stator and selecting appropriate values of external rotor resistance the speed-torque curves required for the lowering side of a hoisting motion can be obtained. Plotted in Fig. 18 are the performance curves of an Igranic hoisting controller in which the unbalanced stator voltages are obtained from an auto-transformer having an overhanging winding. Reversing the stator leads connected to the auto-transformer reverses the torque exerted by the motor. The unbalanced stator voltages and rotor external resistance are adjusted so that the characteristics on the lowering side give a good selection of speeds over the working range, and non-overhauling loads are handled satisfactorily at low, medium and high speeds. The pull-out torque of the motor should be not less than three times the torque required to hoist full load in order to obtain low speed on the first lowering notch.

It remains to give some indication as to the probable heating of the motor. The losses are equal to the combined losses arising from the positive and negative sequence voltages equivalent to the unbalanced system. Depending on the amount of unbalance, the stator

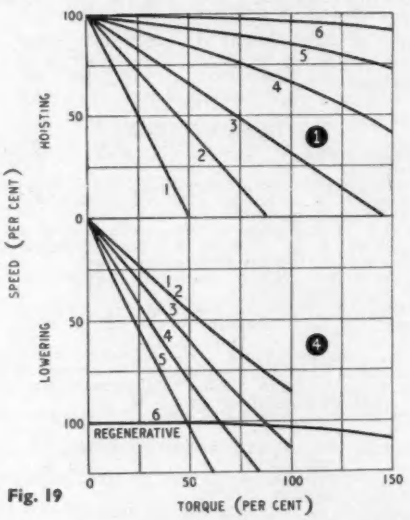


Fig. 19

currents are usually 150 to 300 per cent of the rated full-load current and, since the heating may be three times that at normal full-load, it is evident that investigation of the working conditions is necessary to ensure satisfactory performance of the motor.

Schmitz has shown that with unbalanced stator voltages the lowering characteristics on the first and second notches can be improved by using resistance, capacitance and inductance across the sliprings, and has recorded that speeds of 18 per cent can be obtained with 100 per cent torque. With this modification the speed-torque curve on the first hoisting notch is similar to that of d.c. shunted-armature control.

A.C. Dynamic Braking

This is a special case of the unbalanced voltage system in which the amount of unbalance resulting from equal ± sequences is such that the voltage between two of the motor terminals is zero. The requisite conditions are established by connecting two of the motor terminals and applying single-phase a.c. to the stator winding, and the braking characteristics, Fig. 19, are obtained by varying the external resistance across the sliprings. There is an optimum value of this resistance which gives the best regulation and, in consequence, full load cannot be lowered at speeds less than 60 per cent and the exciting current is 225 per cent. The system is used in conjunction with regenerative and other systems, and also as a retarding point inserted automatically between a lowering notch and the "off" position to reduce the duty of the mechanical holding brake.

Load-Controlled Unbalanced Voltages

In the unbalanced voltage system described above, the unbalancing on a given control point is assumed to be constant. Wickerham investigated the effect of varying the unbalance, as a function of the load, and showed that by connecting a double-wound, a.c. and d.c., saturable core reactor in one of the motor leads the performance of the motor could be varied automatically from that of normal operation at high speed to that of single-phase operation at zero speed.

Based on the research are the several reactor control systems introduced by the Westinghouse Corporation. The block diagram, Fig. 20, illustrates an early form of

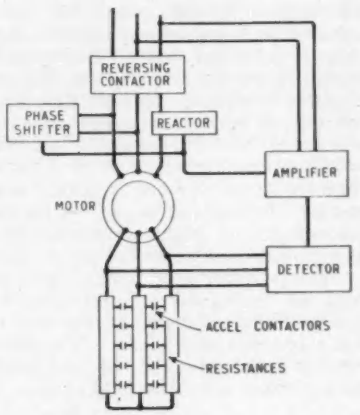
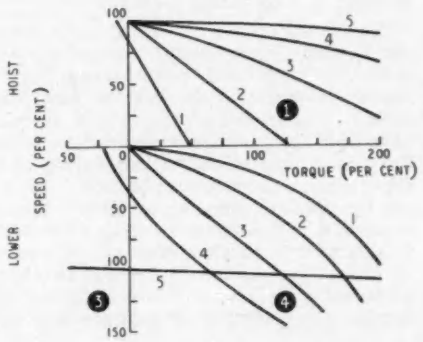


Fig. 20



this control. The reactor, phase shifter and ancillaries, shown separately, are mounted as a self-contained unit. An indication of the motor speed is secured from the rotor circuit, and the a.c. obtained from this source is converted statically and applied to the d.c. winding of the reactor. Thus, the latter is saturated in proportion to the motor speed, and the impedance of the reactor varies inversely as the speed. This results in a speed responsive variable unbalance of the stator voltages without excessive heating of the motor and gives the speed-torque characteristics plotted in Fig. 20.

To lower a non-overhauling load at low speed drive-down torque is secured by a phase shifter which reverses the phase sequence of the stator voltages. This, together with the unbalance of voltage obtained from the reactor, gives the curve L4. The final lowering notch, L5, energises the motor to drive the load downwards giving 100 per cent at no load and regenerative braking for over-hauling loads.

In a recent modification a pilot generator and automatic load detector are used to control the motor torque for reduced-speed hoisting and lowering without operation of rotor-resistance contactors.

A.C. Commutator Motors

Of these, the Schrage variable-speed three-phase commutator motor is the most suitable type for driving main and auxiliary hoisting motions requiring precision control with varying loads and at speeds of 0 to 100 per cent in both directions. It is a constant torque machine having a shunt characteristic and operates satisfactorily with a speed range of 20 to 1. Within this range any hoisting or lowering speed is available and, with the exception that speeds are restricted to a maximum of 100 per cent, it will be seen from Fig. 21 that control characteristics closely resemble those obtained with the d.c. variable-voltage system. In the diagram which indicates performance in Quadrant 1 only five of the many possible speeds are shown. Heavy loads are lowered with graded regenerative braking and the machine operates as a generator feeding back to the supply mains. Two methods of varying the speed are used. One of these utilises an induction regulator and the motor operates with fixed brush position; in the other the angle between the two sets of brushes is altered and the greater the angular displacement the less is the running speed. A selsyn follow-up system ensures that the brush movement and position of the controller are in accord.

Amongst other applications, these motors have been used for driving the hoisting motions of a number of 250-ton fitting-out cranes having two 125-ton main hoists and a 40-ton auxiliary hoist. The three motors are each rated at 90 h.p., 1,000 r.p.m., and brush displacement is used to obtain a speed range of 15 to 1.

Manual *v.* Contactor Control

For d.c. and a.c. motor ratings up to about 50 h.p. at 500 V manually-operated drum controllers of reputable make, in conjunction with overload, no-voltage and emergency protective devices for each of the several motions, can be relied upon to give dependable service when used on general purpose and maintenance cranes. They have done so over a long period and, within the above limits, will continue to be used. For larger motors, and for arduous operating conditions, contactor control is essential. This is not so much on account of greater reliability but is chiefly because of: (*a*) ease and speed of operation by means of a small master switch, or controller, connected in the control circuits, as distinct from the main circuits; (*b*) feasibility of incorporating in the control

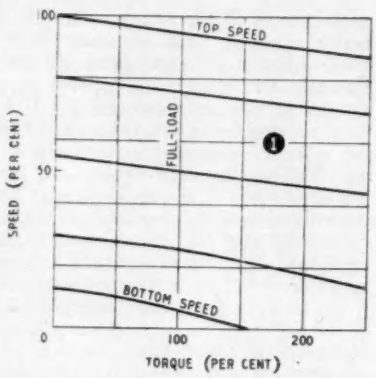


Fig. 21

system a number of desirable features such as automatic acceleration and retardation; and (*c*) improved visibility from the control cabin. When the service conditions are such as to necessitate frequent simultaneous operation of several motions it is advantageous to provide contactor control irrespective of motor sizes. Examples are grabbing cranes and level-luffing wharf cranes used for handling general cargo.

The several methods of obtaining automatic acceleration can be grouped under three headings, namely, current limit, time limit, and combined current-time. In one form of current-limit control series relays are connected and adjusted so as to operate the contactors in the correct sequence as the current approaches the full-load value, and the timing depends on the load on the motor. In time-limit acceleration the operating time is determined by the time setting of the contactors, or relays, and is independent of the load. Both methods are extensively used, but in recent years the trend has been in favour of time-limit control or a combination of the two methods. In course of development are electronic timers but, as yet, it is not possible to predict their effect on the design of crane control gear.

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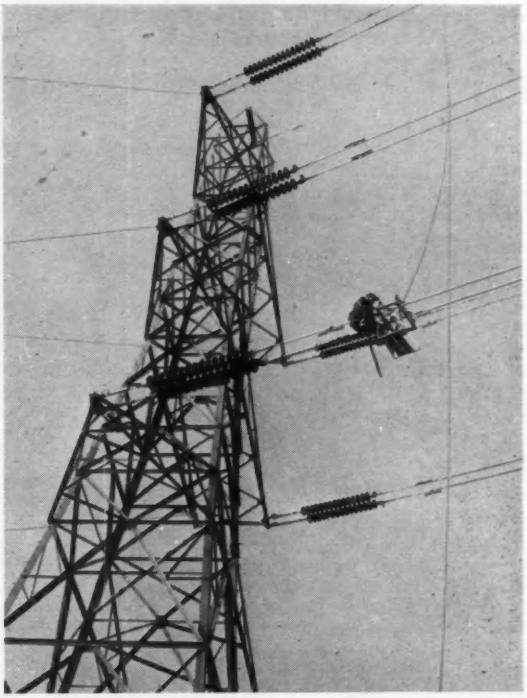
Progress on the Supergrid

CONSTRUCTION OF TILBURY–RAYLEIGH SECTION

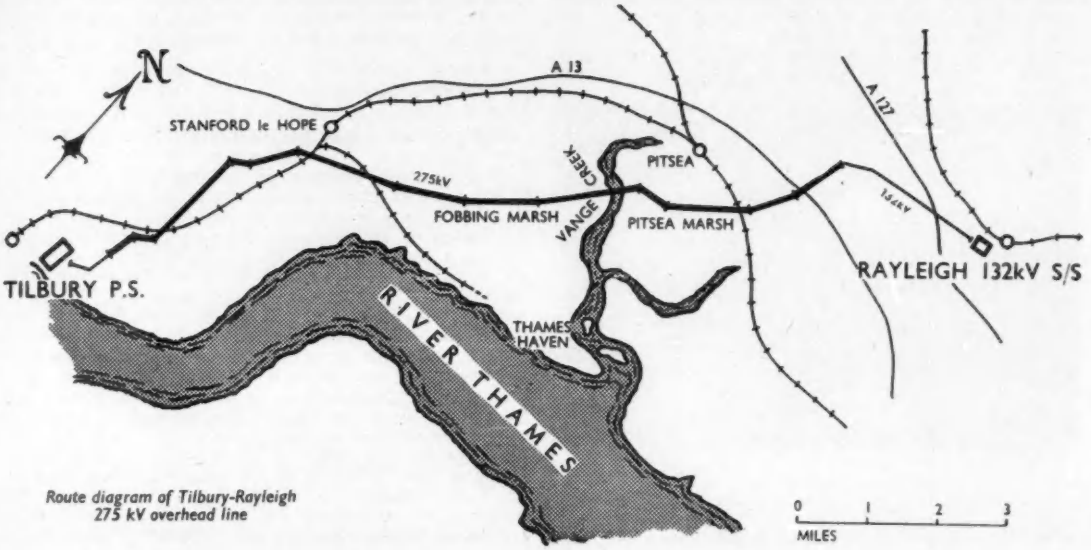


IN 1955 the first section of the 275 kV supergrid to be energised initially at the full voltage was put into commission by the Central Electricity Authority. That section, from Staythorpe to Drakelow in the Nottingham area, was erected by Henley's Contract Department. It consisted of 47 miles of double-circuit overhead line using twin 0·4 sq in copper equivalent steel-cored aluminium conductors erected on lattice steel towers.

A further 11½ miles of the 275 kV grid between Tilbury and Rayleigh in Essex has been erected by Henley's Contract Department during the last few months. This is of standard double-circuit 275 kV construction, with twin 0·4 sq in copper equivalent s.c.a. conductors per phase.

This 275 kV section of the route will eventually connect the proposed 275 kV substations to be built at Tilbury and Rayleigh. In the meantime it is to be energised at 132 kV, and for this purpose it is connected at the Tilbury end by ¾ mile of 132 kV line to the 132 kV substation at Tilbury generating station, and at the Rayleigh end by a further two miles of 132 kV construction to the Rayleigh 132 kV substation. Both of these 132 kV sections use single 0·4 sq in s.c.a. conductors. On the Tilbury section, which will later be used as part of a feeder to the oil refinery at Shell Haven, conductors were erected at reduced tension on standard Blaw Knox 132 kV towers (originally designed for 0·175 sq in conductors), while on the Rayleigh section towers designed by J. L. Eve take the 0·4 sq in s.c.a. conductors strung at full tension. The latter section has been routed so as to form the future connection between the 132 kV and 275 kV substations at Rayleigh.

The line crosses country parallel to the Thames estuary and runs over marshy ground for about six miles of the route; 1½ miles over Tilbury marshes and 4½ miles over the Fobbing and Pitsea marshes. The bad bearing properties of the ground over these stretches necessitated massive piled tower foundations. Some of the piles which were driven at tower footing positions to support the foundations exceeded 90ft in length; the average depth of piles was about 50ft. Reinforced mass concrete foundations were cast for the footings, and connected with



Route diagram of Tilbury-Rayleigh 275 kV overhead line

reinforced tie beams. All the piling was carried out by the West Piling & Construction Co., using shell piles.

Construction of these foundations presented considerable difficulties owing to the wet conditions on the marshes which were aggravated by winter weather. Truck-mixed concrete was used throughout the work. It was off-loaded and taken to tower sites in 3 cu yd capacity dumpers where possible. On some sites inaccessible even to the dumpers, however, narrow gauge railway track was laid and the concrete was run out in trucks. Near the centre of the route, where the line crosses Vange Creek, the towers are 216ft high. These are normal type towers fitted with 80ft extensions, the great height being necessary to maintain clearance over the waterway, which is used by sailing barges.

During stringing operations tubular scaffoldings formed of " unit frames " were used to clear the conductors over roads so as to enable traffic to pass uninterrupted. Following normal twin-conductor practice, on the 275 kV line spacers were fitted at intervals between the two conductors comprising each phase, while sag-adjuster plates, incorporated in the tension insulator set arrangements, enabled the twin conductors to be accurately aligned.

Carlisle-Preston Section

Following these two contracts Henley's have now been awarded a contract, worth £1¼ million, for the erection of 96½ miles of 275 kV line between Harker, near Carlisle in Cumberland, and Penwortham, near Preston, Lancashire. Similar in construction to that employed on the previous contracts, this section of the supergrid will run across hilly country via Penrith, Kendal and Lancaster, and will include a special high crossing over the River Ribble.

British Railways' First 2,000 H.P. Diesel Locomotive

RECENTLY the Eastern Region of British Railways arranged a special run with the first of the new 2,000 h.p. main line diesel-electric locomotives being built at the works of the English Electric Co.'s associates, the Vulcan Foundry, Ltd. Ten of the new locomotives are to be delivered at the rate of one every two weeks and by the autumn of this year it is anticipated that there will be sufficient of them to enable all the principal expresses between London and Norwich to be thus hauled.

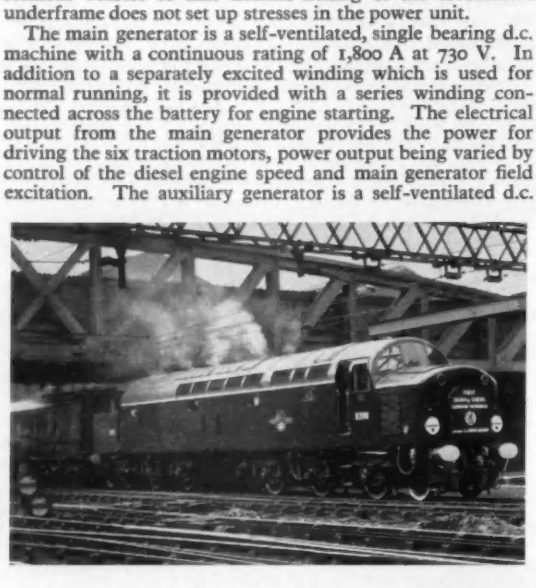
The diesel engine is an English Electric 16SVT Mk. II rated at 2,000 h.p. at 850 r.p.m. It is a 16 cylinder unit with the cylinders arranged in " vee " formation, operating on the four-stroke cycle and supercharged by four Napier exhaust gas driven turbo-chargers. The main generator is bolted up solidly to the diesel engine with the auxiliary generator overhung from the main generator, the whole forming a compact integral power unit. This unit is supported on resilient bearers so that normal flexing of the locomotive underframe does not set up stresses in the power unit.

The main generator is a self-ventilated, single bearing d.c. machine with a continuous rating of 1,800 A at 730 V. In addition to a separately excited winding which is used for normal running, it is provided with a series winding connected across the battery for engine starting. The electrical output from the main generator provides the power for driving the six traction motors, power output being varied by control of the diesel engine speed and main generator field excitation. The auxiliary generator is a self-ventilated d.c. machine with the output voltage maintained at 110 V by a carbon pile voltage regulator. This output provides the l.v. supply for battery charging, operating the control gear and driving the compressor, exhausters and traction motor blowers.

The locomotive's six traction motors are mounted one on each of the main bogie axles. They are of the axle-hung nose-suspended type and are d.c. series wound machines driving the road wheels through single reduction spur gearing. The three motors on each bogie are force-ventilated from a blower mounted in the adjacent nose-end compartment, the air being led by ducts and flexible bellows connections to the air inlet at the commutator end of the motor. Each motor has a continuous rating of 600 A at a nominal 300 V.

The main auxiliaries consist of two exhausters, a compressor, two traction motor blowers, a fuel supply pump and a lubricating oil priming pump, all of which are motor driven from the 110 V d.c. supply.

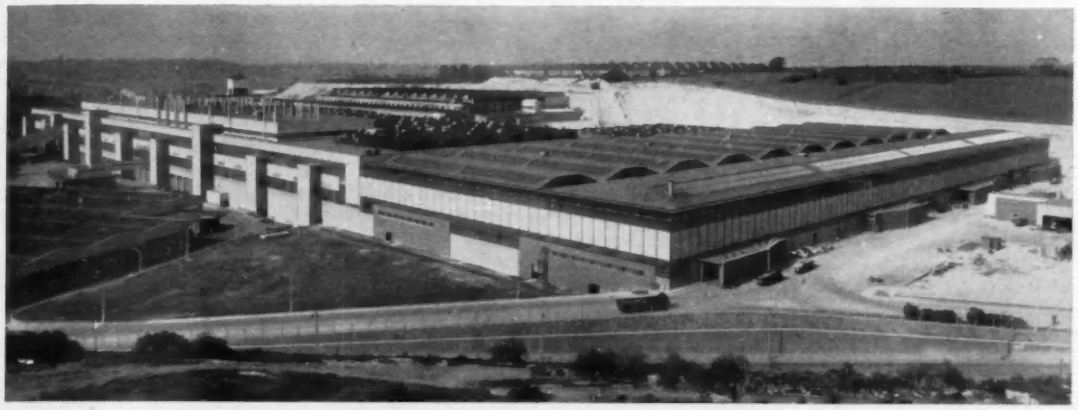
The speed of the diesel engine may be continuously varied between 450 and 850 r.p.m. and the loading is automatically adjusted so that the engine delivers the maximum power corresponding to the selected engine speed. The maximum speed of the locomotive is 90 m.p.h. and on the demonstration run, between London and Norwich, the average speed for the 115 mile journey was just under 60 m.p.h.



The first of the ten 2,000 h.p. English Electric diesel-electric locomotives to be supplied to the Eastern Region of British Railways seen leaving Liverpool Street station at the start of its demonstration run from London to Norwich

Compressor Plant for Canadian Wind Tunnel

THE Canadian Department of National Defence has placed an order valued at over £140,000 with the General Electric Co., Ltd., for a motor-driven centrifugal compressor for installation at the National Aeronautical Establishment, Ottawa, Canada. The plant will have an air output of 40·3 lb/sec at 300 p.s.i.a, and is for use with a new high-speed wind tunnel. The compressor plant (which is arranged in a single line) comprises a G.E.C. 11,200 h.p. salient-pole synchronous motor driving a seven-stage intercooled compressor at 4,500 r.p.m. through an epicyclic gearbox. The output from this l.p. compressor passes through an independent intercooler to a three-stage h.p. compressor driven at 10,000 r.p.m. through a further set of speed-increasing epicyclic gears. The G.E.C. is also supplying the aftercooler for the delivery main, as well as acting as main contractor for the bulk of the other ancillary plant and equipment associated with the compressor unit including the switchgear and motor control gear. The consulting engineers are Dilworth Ewbank of Toronto.



Vauxhall's new 1½ million sq ft car production building

MOTOR VEHICLE PRODUCTION

Large Extensions at Vauxhall Factories

AN expansion programme involving the expenditure of more than £36 million has now been completed by Vauxhall Motors, Ltd. Mr. Philip Copelin, the managing director, said recently that the programme, begun in 1954, was planned to increase productive capacity from 130,000 to 250,000 cars, vans and trucks a year. The main features of the scheme have been the construction of a completely new 1,500,000 sq ft building at the Luton car factory; the extension of the Bedford truck plant at Dunstable from 120,000 to 1,250,000 sq ft; the re-equipment of the Luton machine shops; and the erection of a new 500,000 sq ft building at Dunstable to house all the company's parts and accessories activities.

Before the expansion scheme began, the Luton plant produced both cars and commercial vehicles. To permit increased passenger-car production at Luton, it was necessary to remove truck manufacturing operations to a new site and it was decided to enlarge the small Dunstable plant for this purpose.

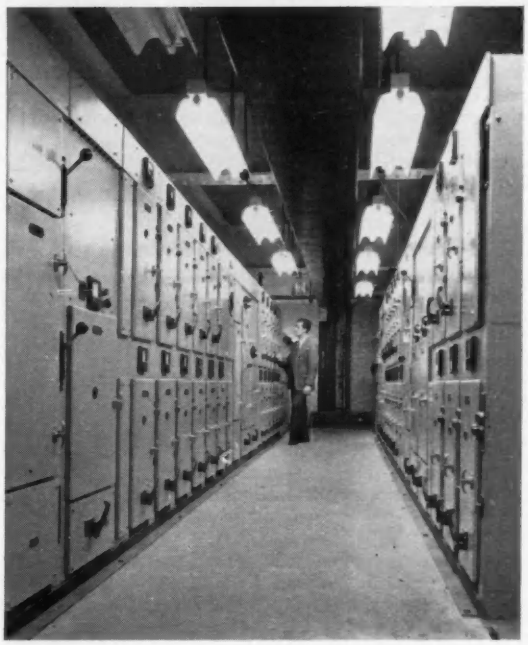
The new passenger-car building at Luton contains press, body building, paint and trim shops, and final assembly operations. Finished mechanical components are fed into it by conveyor from other buildings which now contain several hundred of the most up-to-date machine tools in the motor industry. There are 130 heavy presses ranging from 72in to 156in wide among the 222 new machines in the press shop. Most of these are of the underdrive type, mounted above a continuous basement which contains a scrap metal conveyor system. The paint shop is equipped to spray car bodies and sheet metal components automatically by means of mechanically-operated spray guns, which move in a path following the contours of the car as the body shell moves on its conveyor through the spray booths.

The new building at Luton contains 60 separate conveyors, with a total length of 8·4 miles. The three synchronised conveyors which carry car bodies through rustproofing and painting operations together cover 1·3 miles, while the trim conveyor along which the bodies travel as they receive their interior fittings, is more than half-a-mile long.

More than 2,000 new machines have been installed. Among these are 23 high-precision transfer machines of the most advanced design. Car engine blocks are now produced on a line of 17 machines comprising 110 automatic transfer stations. This line, which can produce 60 engine cylinder blocks an hour, performs a total of 565 separate machining operations on each block.

Power for the new building at Luton is taken from the primary substation at 6,600 V to the h.v. side of the substation in the basement and also to the substation in the boiler house. These two substations are looped together

Main switch and control panels in the new boiler house at Luton



to give an alternative feed for the boiler house in case of breakdown. Supplies at 6,600 V are taken to five transformer substations situated in various areas of the building. The outgoing supply, feeding power and lighting in the block, is distributed at 440 V.

Welding supplies are fed from the basement substation at 6,600 V to transformers on the shop floor. From these, a supply at 760 V between phases is distributed by a busbar system to give 440 V between phase and neutral. A 440 V supply is distributed by 2,000 A busbars in the press shop basement, the presses being connected to a 300 A distribution busbar system. For the other main block areas, distribution is by cubicle switch-fuse panels, sited to suit local loads, and feeds from this for smaller loads are taken to local fuseboards.

Lighting is mainly by 8ft twin-tube fluorescent fittings on a continuous trunking over the working areas on a 440 V supply. The 16,000 twin-tube fittings are connected by a total of 66 miles of cable and are controlled by three-phase contactors.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Electric Heat Treatment

I HAVE read with interest the report in the *Electrical Review* dated 18th April on the E.D.A. Sales Conference and in particular that section headed "Electric Heat Treatment." It is, indeed, pleasing to note the increased interest now being taken by the Area Boards in this important load. But some of the comments Mr. Patterson is reported to have made cannot really go unchallenged.

It is stated that because manufacturers—presumably manufacturers of electric furnaces and electric heat-treatment equipment—were often reluctant to go to the expense of producing a prototype for experimental purposes, the Midlands Electricity Board had established an Industrial Development Centre in which new applications were tried out with apparatus constructed by the Board's own staff. Does Mr. Patterson really believe that electric furnace manufacturers have developed the industry to its present state without building prototypes? And does he really think that his Board's own staff have the background and experience to develop and construct electric heat-treatment equipment better than that developed by specialists with 40 or 50 years' experience behind them?

In comparison with some sections of the electrical industry, the electric furnace industry is relatively small—the Board of Trade returns for 1956 show an annual turnover of about £7 million—and specialist knowledge of furnace design is not so widespread as that of some equipment. The best of the limited number of designers have naturally gravitated towards the reputable furnace manufacturers and it would appear to be quite uneconomic for the individual Area Boards to engage and maintain on their staffs people who could be employed much more usefully in the national interest in organisations supplying not only the home but also the export markets. Nor, I venture to suggest, is there any need for them so to do—their purpose, as laid down by Parliament, is to supply energy and not to engage in the manufacture of equipment which industry itself can and does supply efficiently.

Another important factor which appears to have been entirely ignored is that the progressive furnace manufacturer supplies not only the plant but a complete heat-treatment process, requiring in its development the employment of competent metallurgists, chemists, physicists and other qualified technical personnel as well as electrical and mechanical engineers. The research and development departments—electric furnace makers do indeed have such departments in their organisations—are well staffed and well equipped not only for building prototypes. That is a small part of a development programme which usually starts as a new process project on a laboratory scale and much time and expenditure is devoted to the initial developments before a prototype can be designed and built to carry out effectively the improved heat-treatment process. The present state of development of the engineering and allied industries is due in no small measure to the materials now available, the improvements in which have been made possible by the manufacturers of heat-treatment plant keeping ahead in the development of new equipment and processes.

Surely public money could be better spent than by the Area Boards endeavouring to duplicate—at second best in any case—the efforts of private industry who have progressed to their present state without public funds. The furnace makers would welcome the co-operation of the Area Boards and would assist them in dealing with any consumer requiring heat-treatment equipment. They have specialists on their staffs precisely for this purpose who can discuss, with knowledge based on practical experience, enamelling of brooches, infra-red heating of glass, "dropping" of glass tubes, and a host of other processes, all of which, far from being novel applications as is implied in the report, have been everyday applications for years.

Watford, Herts. J. E. ORAM,
Managing Director,
Wild-Barfield Electric Furnaces, Ltd.

Off-Peak Heating

IN this correspondence Mr. A. C. Hazel has the advantage of viewing the situation from one point of view, whereas those of us in the supply industry are required to look at it from many angles. Whilst it may be true that under certain conditions panel heaters are economic and efficient, underfloor heating has the great advantage of producing its results without introducing any above-floor obstacles whatever. In dealing with the space heating of premises the problem of knowing where to put the heating units is a constantly recurring one.

It may be, as Mr. Hazel suggests, that a panel heater installation would show a saving in units consumed, but until comparable tests have been carried out there is no definite scientific evidence upon which a conclusion can be reached.

It should also be remembered that electricity consumption is not the only item to be considered, and there are those who would be quite willing to expend a few additional units if in so doing they could obtain conveniences and benefits which do not arise under other conditions.

Tests of different kinds are constantly being carried out by different bodies, and information of varying kinds is

being produced year by year, and I have no doubt that as this is forthcoming we shall make our way towards a situation which will be generally beneficial to most people. In the meantime it would appear to be unwise to limit our activities in any way.

It is difficult, of course, to say how long this process will take, for despite the fact that evidence shows the open fire grate to be much the most inefficient unit, it is still being installed by architects and builders all over the country as though it had been proved to be a most efficient piece of heating apparatus. One can only look forward hopefully to the day when it will be relegated to the sphere of ornamentation and decoration.

Elton, Peterborough. L. HOULDRIDGE.

MR. HAZEL, in his letter regarding off-peak heating (18th April), hits the nail on the head when he described the adequately heated Scandinavian home as " delightfully warm," but how does he propose to set about converting the greater part of the populace in this country to his way of thinking? It is my experience that most of my compatriots interpret a comfortable warmth as " unhealthy fug," and counter with wide-opened windows any attempt to achieve a reasonable temperature.

One important aspect of the problem of obtaining efficient and comfortable house heating is that of insulation. The usually draughty single windows of the average British building are prime contributors to the loss of heat, and, together with the question of more efficient thermal insulation of walls and ceilings, these should be given the concentrated attention of architects and builders before embarking on the provision of heating. Double windows with a layer of air between, virtually standard in Scandinavia, are practically unknown here, but although they would no doubt prove a prohibitive expense if specially fitted in isolated cases in this country, they could be easily and cheaply produced provided the interest of the building profession were so aroused as to lead to manufacture in quantity.

Once the appalling heat loss of the average British house has been dealt with, the electrical industry can go ahead with its programme of domestic heating with confidence, but unless the task is tackled in that order, the prohibitive cost of maintaining the home at a reasonable temperature will damp the ardour of the householder, and will induce a hard core of prejudice which will be difficult to disperse.

Orpington, Kent. C. HAFFNER.

Underground Cable Laying

I AM prompted by Mr. J. E. Walker's article on underground cable laying in your issue of 11th April to suggest that in some cases cable laying operations might be simplified by the use of a compressed air driven winch. When cables are laid in ducts the use of a winch is almost essential and even when they are laid in open trenches it is often necessary to augment the labour force for the pulling operation unless a winch is used.

Now that a supply of compressed air is available on most cable laying jobs it would seem to be a natural step to use the air as power to drive the winch. Moreover, a compressed air winch has at least three distinct advantages. Firstly, because of its small physical size it can easily be anchored by dropping it into the draw-pit or a hole dug at the end of the cable trench. Secondly, this type of winch has an infinitely variable speed range and is easily controlled down to the merest crawl. Finally, the winch will automatically stop if the load on it exceeds its capacity.

Birmingham, 22. E. C. COOPER.

That Bakelite Lampholder

THE Press Officer of the B.S.I. attempts to laugh off my criticisms, but I assure you that they were seriously meant.

The charmed-circle attitude is well exemplified by the Divisional Chief Technical Officer's letter; the committee are reviewing B.S.52 so all will be well. But, if the intention is, as implied in the Press Officer's letter, that " qualified persons " should be kept informed, might not your readers have been told of the progress made? In particular no mention is made of the supplement relating to lampholders of moulded material, a draft of which was issued for comments last September.

" IGNOTUS."

Plant Design with Digital Computers

A FIVE-DAY symposium on the application of digital computers to the design of electrical plant was held at Queen Mary College (University of London) from 14th to 18th April. It was attended by 40 designers from a dozen of the leading manufacturers of electrical machines and transformers.

The programme included introductory lectures by Mr. J. V. Oldfield of Queen Mary College; an introduction to programming and design problems and to the use of the computer in research projects by Mr. E. A. Allwright of the B.T.H. Co.; a review of work that had already been done in Britain on the use of digital computers in the design of power transformers based on papers by Mr. H. L. Thomas and Mr. K. S. Rowe (Ferranti) and Mr. D. McDonald (Bruce Peebles); a description of a programme for designing induction motors by Mr. A. J. B. Reece and Mr. B. J. Chalmers (English Electric Co.); a demonstration of the programme on " Deuce " at Marconi House and then demonstrations on " Pegasus " at Portland Place; a paper by Mr. B. M. Bird (Metropolitan-Vickers) on the use of an Elliott computer for the design of d.c. machines; and a paper by Mr. T. Baldwin (B.T.H. Co.) describing several lengthy programmes which had been in regular use for some months in the design of steam turbines and turbo-alternators.

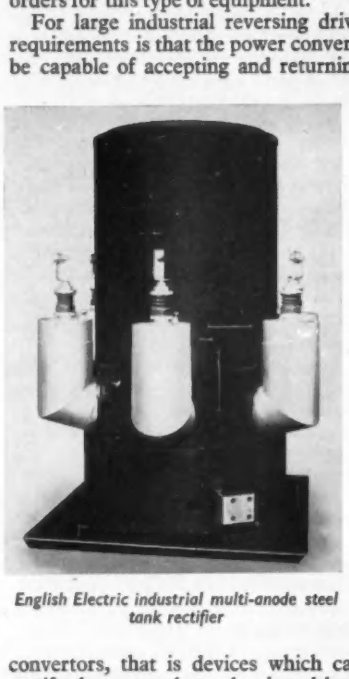
The last morning was devoted to a discussion of the future prospects for the use of computers in electrical plant design and was opened by Mr. W. E. Scott (English Electric), Mr. W. J. Gibbs (B.T.H.) and Mr. B. Birtwistle (Metropolitan-Vickers). It became apparent from the various discussions that the first problem was to introduce the designer himself to the art of using a computer. This could be done by creating a small programming group to serve several departments in the development of programmes of the type described by Mr. Baldwin. Only the largest computers at present available in this country appeared to be satisfactory for optimum final designs of electrical machines, but it was felt that before optimisation final designs could be left entirely to computers. The general conclusion was that the design offices should begin to train designers in the use of computers in the analysis of trial designs in the manner described in most of the papers so as to be able to make good use of any computers to which they would no doubt soon be able to obtain access.

LARGE REVERSING DRIVES

The Use of Mercury Arc Convertors

THE practical application of mercury-arc convertors for large reversing drives has only recently reached the standard of reliability required by commercial users. Although there have been tentative applications to machine tool drives, it was not until last year that the steel mill and mining industries in this country placed orders for this type of equipment.

For large industrial reversing drives one of the main requirements is that the power conversion equipment shall be capable of accepting and returning to the a.c. system any power generated by the motor in braking it to rest. It has been common practice to employ d.c. mill motors fed from motor-generator sets sometimes driven by synchronous motors, but more often by induction motors frequently using a flywheel to smooth out the heavy load peaks. Mine winders commonly employ either a.c. motor or d.c. motor drive.



English Electric industrial multi-anode steel tank rectifier

Mercury-arc convertors, that is devices which can invert as well as rectify, have now been developed by the English Electric Co., Ltd., for use with large reversing drives and, last week, we attended an impressive demonstration at Stafford at which full-size rectifier-fed motors were reversed under field and armature switching control. In dealing with both multi-anode and single-anode devices it is the company's experience that the rival claims of one over the other for superiority of principle cannot be supported in fact. Since the weight of experience lies with the multi-anode tank the company elected to use this type of convertor for the demonstrations.

When using mercury-arc convertors for a reversing drive a choice of three methods is open: cross-connected convertors; armature reversal; and field reversal. Cross-connected convertors entail the use of two sets of convertor equipment, permanently connected to the machine bars. One acts as the rectifier for forward rotation and as an invertor for braking when running in reverse rotation. The other performs the same function for contra-rotation. This circuit avoids the reversal of either motor flux or motor armature. There is thus, negligible "dead" or "lost" time at the point of change-over from motoring to braking. Such an arrangement is necessary when rapid and continuous speed control of high-inertia drives is wanted. Usually, this system is no more expensive in first cost than an equivalent motor-generator set and, of course, it retains the efficiency advantage of convertors.

With the somewhat less exacting requirements of reversing mills and some winders where a short period of "dead" time (say, 0·3 sec or longer) is tolerable, some saving in first cost can be accomplished by employing the same convertor for both motoring and braking duty. Because the mercury-arc convertor can pass current in one direction only it becomes necessary to reverse the motor polarity when changing from motoring to braking. This can be accomplished either by reversing the armature connections or by reversing the motor field.

With armature reversal, at the instant when it is desired to initiate braking, the grid impulses are phased back to the position for maximum invertor back e.m.f.: this interrupts the motor current and the armature connections are then reversed by means of an electro-pneumatic reversing switch. When this operation is complete the phase position of the convertor grid impulses is advanced to reduce the invertor back e.m.f. to a suitable level to allow braking current to flow. By continuous advance of the grid phase angle the motor will come to rest and, if the phase advancing be continued, can be brought up to speed in the reverse direction. This system of reversal is being used on the rolling mill drives now in course of construction in the English Electric Stafford works.

With field reversal, the procedure is similar except that, if desired, the inverter e.m.f. can be reduced to allow braking current to flow as soon as the machine e.m.f. has reversed. The inverter back e.m.f. is controlled at the level which provides the requisite braking current until the motor is at rest. Reverse rotation of the motor is obtained by further advance of the grid phase position.

Choice of Method

The principal difference between the two methods lies in the fact that armature reversal can be made slightly faster than field reversal. Armature reversal involves the use of a relatively heavy current reversing switch which, however, does not have to break current. It must, of course, be capable of withstanding frequent operation. With field reversal there is associated the problem of reversing a small current in a highly inductive circuit and of building up that current in the reverse direction as quickly as possible. The use of laminated frame d.c. machines assists materially in reducing the flux reversal time.

With an a.c. system of adequate capacity the mercury arc convertor has a number of advantages over the m.g. set either for rolling mill or d.c. winder duty. These advantages include lower capital cost, lower foundation costs, better efficiency, and less noise.

Hinkley Point Switchgear Contract

THE English Electric Co., Ltd., has received a contract from the Central Electricity Generating Board for the supply of switchgear for the Hinkley Point nuclear generating station in Somerset. The contract, which is valued at £980,000, covers the generator, feeder, station transformer and bus coupler circuits as well as fourteen 7,500 MVA air-blast circuit-breakers with associated control and relay panels.

INDUSTRY AND THE HOUSE

Reactions to the Budget

By A. M. F. PALMER, A.M.I.E.E. M.Inst.F., M.P.

I AM in some little difficulty about reporting on those Parliamentary events that have occurred since the House resumed after the Easter recess because during part of the Budget discussion I was in Luxembourg with fellow members studying the work of the European Coal and Steel Community. I predict that in the next few years—with either major political party in power—these new-style European economic institutions, which have obviously now taken firm root, will not only need to receive closer British attention but will in fact have such attention. The Coal and Steel Community was the beginning; Euratom and the Common Market proposals have followed; it seems unlikely that the United Kingdom can maintain indefinitely her present attitude of friendly detachment.

Purchase Tax Anomaly Removed

However, this year Luxembourg has prevented me describing as in past years the pleasant, conventional Budget scene; the packed benches; the air of expectancy; the Chancellor droning on; the careful sips of water (or other mixture); the cheers and ironical laughter. But I imagine all went according to the honoured precedents. The real issue is the reactions of Members now the Budget is behind us. Mr. Heathcoat Amory's effort seems to me to have made little general impact one way or the other, but those who have campaigned for the electrical industry have at least something to rejoice about. The reduction and simplification of purchase tax rates means that the unfair burden on the sale of many electrical appliances has been substantially eased. Also, justice has been done by balancing properly the rate of tax between different forms of domestic heating. Oil heaters in future, like electric heaters and fires, will pay the same rate—30 per cent.

The improvement in the capital allowance for industrial plant, machinery and buildings has met with general approval. Indeed, the major criticism of the Labour Opposition of the Budget—as of the Government's economic policy generally—is that not enough is done by it to encourage industrial expansion. Mr. Heathcoat Amory is determined apparently to hold steadily to the restrictive counter-inflationary attitude of his predecessor, Mr. Thorneycroft. Here then is the divide: between a Conservative Government that believes the economy must run for the time being in lower gear, if it is to maintain a steady course, and a Labour Opposition wanting a high gear for the industrial machine to override all present obstacles. Mr. Gaitskell and Mr. Wilson stress constantly the need for improved industrial productivity, even if this does mean physical controls, for balance of payment reasons, and a firm guarantee to the trade unions that improvements will be shared by the industrial worker.

With a General Election growing ever closer, Conservatives are disappointed that there were no direct Budget taxation concessions, but equally Labour is careful not to advocate increased taxation. Taxation is a factor to be reckoned with in a full employment election; unemployment or short time would reduce its importance.

Strong exception is taken to the Chancellor's plan to act retrospectively against that form of tax evasion known as "dividend stripping." On general grounds it is hard to see that anyone can seriously defend a financial practice which is not good for the reputation of business or industry, but Conservative back benchers have objected to the proposed procedure as a matter of principle. They argue that in a constitutionally governed country it is bad that individuals should be proceeded against for actions legal when taken but subsequently made illegal. It seems likely that Mr. Amory will think again.

Not a lot was said in the Budget statement but the view is widely held that the Government will bring in new proposals for the financing of at least some of the nationalised industries. Should that prove to be the case, then the Area Electricity Boards and the Gas Boards will certainly be the first candidates for the "discipline of the market." It will be remembered that during the discussion on the 1957 Electricity Act amendments were made giving, under some circumstances, the right to the Electricity Boards to issue their own stock, subject to Electricity Council and Ministry approval. The debatable point now is whether this should be done with or without Treasury guarantee.

Details of the present approved capital investment in the coal, gas and electricity industries were given in a recently published White Paper. Although it has been necessary apparently for the nationalised boards—in discussion with the Minister—to revise their plans so as to limit their claims on the country's resources the general effect is not alarming; the total financial burden is spread over a rather longer period than formerly.

Gas-Electricity Inquiry

The committee of investigation into the possibility of improvement in co-operation between the electricity and gas industries has started work and is taking evidence. It would seem that the Ministry is anxious to make it clear that the committee is not concerned with the general policy of either industry. Press statements have emphasised that in both Houses of Parliament it has been said on numerous occasions that the Government is all in favour of competition between the two industries. If any misunderstanding has arisen it is probably because of a certain conflict between the original statement made by Lord Mills, the Minister, in the House of Lords and the later statement made by the Parliamentary Secretary, Mr. Horobin, in the Commons. In the course of a general debate Lord Mills said that the committee would be empowered to consider alleged unnecessary advertising, hire-purchase, capital investment, the economies of joint meter reading and the sale of appliances. The Commons statement confined the work of the committee simply to the performance of statutory functions and the administration of services of a like kind. When questioned, Mr. Maudling, the Paymaster General, adroitly got out of the difficulty by saying that the terms of reference were as stated in the second answer, but the committee could if it wished look at the other points "in so far as they regarded them as relevant." That is, of course, a different approach altogether. My guess is that the Government has wisely had second thoughts on what this committee should do and has circumscribed the field of investigation.

Parliamentary Report

Railway Electrification Unaffected by Capital Cuts

The slowing down of capital investment in the railway modernisation programme will have no effect on the electrification plans, Mr. G. R. H. Nugent, Parliamentary Secretary, Ministry of Transport, told the House of Commons last week when railway finances were discussed.

He said that the British Transport Commission had proposed that the expenditure on the programme in 1958 should be £151 million and in 1959, £148 million. The Government had agreed to allow £145 million for each year. In spite of the serious financial crisis, these were no more than marginal reductions.

There had been much comment about the main line diesel locomotives, he said. It was true that it had been necessary to cut the accelerated programmes which the Regions put up. Nevertheless, 155 diesels were expected to be brought into service this year and 200 next year. These would be of valuable benefit in lowering running costs and making for better time-keeping.

Some slowing up had taken place in station building. "But electrification, which is an important part of the modernisation programme, has gone on without a check," he continued. "It would obviously have been most unwise to stop these very big electrification schemes, which have no value until they are completed. They were given top priority and, in the main, are going ahead very satisfactorily."

Mr. A. E. Davies said he understood that, because of the sudden cuts, the phasing of the scheme had been severely upset and there would be considerable disturbance in bringing into effect parts of the modernisation scheme.

Mr. Ronald Russell said that he had recently visited countries in Europe and what he had seen led him to believe that Britain was a long way behind in electrification.

Mr. A. J. Champion spoke of the difficult changes that would have to be made in the railway shops with the transfer from steam to electricity. The B.T.C. might learn something from the change that had been made by the French Railways at the Dijon workshops. There he had seen men who had been boilersmiths now being employed as skilled electrical mechanics, after special training.

Scientific Manpower

In reply to a question by Mr. Willey regarding the emigration of scientists and engineers, the Parliamentary Secretary to the Ministry of Works (Mr. Harmar Nicholls) said that investigations were still continuing. The Committee on Scientific Manpower hoped to obtain information from university professors of engineering and from professional institutions. Most of the firms approached said that their emigration losses were not excessive in relation to the size of their technical staffs.

Mr. Willey also asked what inquiries were being conducted to ascertain the distribution of research scientists in industry.

Mr. Nicholls said it was planned to carry out a second inquiry into the number of qualified scientists and engineers employed in Great Britain, similar in scope to the first inquiry in 1955-56. Employers would again be asked to indicate the number of scientists and engineers who were mainly engaged on research and development.

H.P. Interest Rates

Mr. Osborne asked the President of the Board of Trade if he was aware that recently hire-purchase interest rates of 70 per cent on electric fires and 69 per cent on bicycles had been charged, and if he would take action to limit these interest rates, and so protect both the honest trader and the consumer.

Mr. F. J. Erroll, Parliamentary Secretary, said he had seen reports of a recent survey which quoted these rates but indicated that they were exceptional. The answer to the second part of the question was "No." The Hire-Purchase Acts and the Advertisements (Hire-Purchase) Act, 1957, in his view, gave adequate protection to the honest trader and to the consumer.

Atomic Energy in Europe

Asked by Mr. Mason whether he would consider the question of a joint working party between the Atomic Energy Authority and Euratom, the Prime Minister (Mr. Macmillan) said: "We are anxious to co-operate with Western European countries in atomic energy work and we choose the form of co-operation which we believe to be best suited to the circumstances." They had bilateral agreements with five of the six Euratom countries, and were studying the question of their future relationship with Euratom itself. He did not think that the working party suggested would help at this stage.

Research Programmes

Mr. Leslie Thomas asked what means the Department of Scientific and Industrial Research had for assessing the economic value of research undertaken at the public expense or for selecting research programmes likely to be of most benefit to the national economy.

Mr. Nicholls said the Council for Scientific and Industrial Research had recently set up an Economics Committee to advise it on the economic aspects of its scientific research policy and on the probable economic value of particular researches. The chairman of the committee was Professor E. A. G. Robinson, Professor of Economics at Cambridge.

Purchase Tax and Prices

In reply to a question by Mrs. Jean Mann, the President of the Board of Trade (Sir David Eccles) said that purchase tax was only one element in prices. He could not ensure that reductions in tax would be exactly reflected in the price but he hoped that generally this would be the case. Competition was a powerful agent to this end.

Mrs. Mann asked if the Government were aware that the goods which were reduced in price by the Electricity Boards after the Budget were immediately increased in price the following morning by the manufacturers.

Sir David Eccles said that according to his information very many price reductions had been made. If Mrs. Mann brought particular examples to him he would examine them.

Mr. George Thomas said that one large manufacturing firm dealing in vacuum cleaners first sent out to the trade to say it was transferring the relief on to the manufacturing costs, and it was only after publicity had been given to this that the firm changed its mind.

Sir David Eccles said his information was that manufacturers of vacuum cleaners had reduced their prices.

Nuclear Power Programme

Asked by Mr. Mason to what extent the atomic power station building programme had been affected by improved techniques, Mr. Maudling said it now seemed likely that the programme could be fulfilled with fourteen or fewer nuclear stations compared to the original estimate of nineteen.

Tribunals and Inquiries

During the committee discussion in the House of Lords on the Tribunals and Inquiries Bill, Lord Lucas of Chilworth proposed that the inspector or persons appointed to conduct the inquiry should be selected from a panel of persons appointed by the Lord Chancellor.

The Lord Chancellor said that in the Franks Committee's report there had been no complaint about the competence or impartiality of inspectors, and the committee had recommended that the corps of inspectors should be kept in touch with the policy developments in a Department. He had always found with technical inspectors, such as those employed by the Minister of Power, that just because they had technical qualifications they were not therefore Philistines on every other point. Where amenity questions arose, the technical inspector was accompanied by a general inspector.

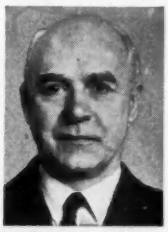
The amendment was, by leave, withdrawn.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Because of the heavy responsibilities which he already bears as deputy chairman of the Central Electricity Generating Board, **Mr. C. R. King,** C.B.E., has been compelled to resign from the chairmanship of the National Inspection Council for Electrical Installation Contracting although he will continue to represent the Generating Board on the N.I.C. He is succeeded as chairman by **Mr. A. F. Plummer,** M.C., Associate I.E.E., who is a leader in the electrical contracting industry and a past-president of the Electrical Contractors' Association. He was also chairman of the Electrical Industries Club for 1957-58.

Mr. A. F. Plummer



Mr. C. T. Melling

Mr. A. N. Irens

Mr. H. V. Pugh

In view of his duties as chairman of the Electricity Council, **Sir Henry Self,** K.C.B., has found it necessary to resign from the National Inspection Board. His successor as representative of the Electricity Council is **Mr. C. T. Melling,** C.B.E., who has previously served on the National Inspection Board as a representative of the Area Electricity Boards.

Mr. A. N. Irens, M.Sc.(Eng.), M.I.E.E. (chairman, South Western Electricity Board), and **Mr. H. V. Pugh,** A.M.C.T., M.I.E.E. (chairman, Eastern Electricity Board), will now be the Area Board representatives, with **Mr. T. E. Daniel** (chairman, North Western Electricity Board), who has served in this capacity since the inception of the Inspection Board.

The National Inspection Council for Electrical Installation Contracting has appointed **Mr. M. J. Pryor** as its inspecting engineer for the South Wales Area. In addition to South Wales, he will also cover Monmouthshire, Herefordshire and a part of Gloucestershire.

Mr. Pryor served his apprenticeship with the Wessex Electricity Co., to whom he returned after war service with the Territorial Army. On nationalisation of the electricity supply industry he was appointed sales and service representative in the Swindon District of the Southern Electricity Board, and in 1954 he was appointed second assistant district commercial engineer (service engineer) in the New Mills District of the North Western Electricity Board. Mr. Pryor took up his new appointment on 1st April.

The president of the Electrical Power Engineers' Association for 1958-59 is **Mr. C. Donnellan,** B.Sc., and the president-elect **Mr. R. Johnson.**

Mr. Donnellan is senior assistant engineer, operational research, in the North Eastern Division of the C.E.G.B., and he was previously a control engineer in the joint system control organisation of the North-East. Before nationalisation he held various appointments with the North Eastern Electric Supply Co. He has been a member of the E.P.E.A. since 1930, and he is a member of the National Joint Board and the National Joint Advisory Council for the Electricity Supply Industry.

Mr. L. E. Willson, manager of the Southampton office of the Skefko Ball Bearing Co., Ltd., has been appointed an assistant sales manager and commenced his new duties at the company's head office at Luton on 1st May. He is succeeded at Southampton by **Mr. G. T. Boden** from the London office.

The Television Society has awarded the following Premiums, for outstanding papers read before the London meetings in 1956-57:—*Wireless World* Premium to **Dr. D. Gabor,** F.R.S. (Imperial College), for his paper on "A New Picture Tube"; Mervyn Premium to **Dr. E. L. C. White,** M.A. (E.M.I. Research Department), for his paper on "Alternatives to the N.T.S.C. Colour System"; Mullard Premium to **Mr. S. N. F. Doherty,** B.Sc., and **Mr. P. L. Mothersole** (Mullard Research Laboratories) for their paper on "Automatic Gain Control Circuits in Television Receivers"; E.M.I. Premium to **Dr. J. A. Saxton,** M.I.E.E. (D.S.I.R. Radio Research Station), for his paper on "Scatter Propagation and its Application to Television"; *Electronic Engineering* Premium to **Dr. R. Pearce,** B.Sc., A.M.I.E.E. (E.M.I. Research Department), for his paper on "The Return of Electrostatic Focusing"; and Pye Premium to **Mr. Ian Atkins** (senior dramatic producer, B.B.C. Television) for his paper on "Studio Production Techniques."

Mr. H. S. Davidson, T.D., M.I.E.E., transmission engineer of the Midlands Division of the Central Electricity Generating Board, has been appointed controller of the South Western Division of the Board.

Mr. H. S. Davidson

Mr. Davidson was apprenticed to Drake & Gorham, Ltd., and, after commissioned service in the first war, held positions with the Carlisle and Wolverhampton Corporations. In 1930 he was appointed section engineer in the Central England Area of the Central Electricity Board and three years later became senior assistant transmission engineer.

As a Territorial officer Mr. Davidson was called up in 1939 and served in North Africa and Italy. On his return to the Central England Area of the C.E.B. he became transmission engineer and took over similar duties in the Midlands Division on the nationalisation of the electricity supply industry in 1948. He is a past-chairman of the South Midlands Centre of the Institution of Electrical Engineers.

Mr. H. H. Gott, M.A., A.M.I.Mech.E., who, as we reported in our last issue, has been appointed nuclear plant design engineer of the Central Electricity Generating Board, was educated at Alsop High School, Liverpool, and Clare College, Cambridge. He served a year with the Automatic Telephone & Electric Co., Ltd., before joining Power Jets, Ltd., as junior engineer in 1940 where he remained four years and then joined the Cierva Autogiro Co. In 1945 he worked on marine gas turbines at the Admiralty Engineering Laboratory, after which he joined the Control Commission for Germany. In 1946

Mr. H. H. Gott

he went to the Ministry of Supply at Risley as technical engineer working on gas-cooled reactors. As chief technical engineer he was concerned with the Windscale reactors and the Capenhurst plant before becoming assistant chief engineer on the fast reactor project. With the initiation of the nuclear power programme he was appointed industrial liaison engineer for the Atomic Energy Authority and was promoted to his present post as chief engineer, reactor design, in the Industrial Power Branch of the A.E.A.

The British Thomson-Houston Co., Ltd., has made the following changes in managership of its district offices:—

Mr. F. C. Barford, T.D., M.I.E.E., relinquished his position as manager, Birmingham district, at the end of April, following his recent appointment as manager, Small Industrial Machines Department, Blackheath, Birmingham. He is succeeded by **Mr. K. J. Clarke,** A.M.I.E.E., who has moved from the Sheffield district where he has been manager since October last year. **Mr. W. J. Wilson,** A.M.I.E.E., manager, Leeds district, has succeeded Mr. Clarke as manager, Sheffield district, and **Mr. J. N. Griffiths,** Associate I.E.E., is appointed manager, Leeds district.

Mr. Barford served his apprenticeship with the B.T.H. Co. and received his technical training at the Rugby College of Technology and Arts. After a period in the Supply Department (now Industrial Machines Department) at Rugby he was transferred to the power engineering staff at the Glasgow office. He was commissioned in the R.A.O.C. in 1939 and transferred to R.E.M.E. in 1942. Attaining the rank of lieut.-colonel, he held appointments as assistant director of mechanical engineering and later C.R.E.M.E. in anti-aircraft formations in this country. On demobilisation in 1945 Mr. Barford rejoined the British Thomson-Houston Co. at the Manchester office, transferring a year later to Newcastle as deputy manager. In 1947 he was appointed manager, Newcastle district, and in 1953 he took over managership of the Manchester district. Two years later he was appointed manager, Birmingham district.

Mr. F. C. Barford

Mr. K. J. Clarke

Mr. W. J. Wilson

Mr. J. N. Griffiths

Mr. Clarke, after completing an engineering apprenticeship at the B.T.H. Coventry works in 1931, was appointed to the staff of the Industrial Machines Department, Rugby. In 1936 he was posted to the company's Birmingham office, and in 1942 returned to Coventry for special duties associated with war production, rejoining the Birmingham district in 1944. Since then he has specialised on electrical equipment for the steel and mining industries. He is a member of the Association of Mining Electrical and Mechanical Engineers.

Mr. Wilson was educated at Acton and Chiswick Polytechnic and Acton Technical College before commencing an apprenticeship at the B.T.H. Willesden works. After periods in the switchgear drawing office, Tender Engineering Department, and Switchgear Sales Department (now Switchgear Contracts) he transferred to Sheffield in 1950, and three years later to Manchester. He was appointed assistant manager of the Leeds district in 1954 and manager in 1955.

Mr. Griffiths was educated at Smethwick Technical School and then obtained practical experience with various industrial undertakings in Birmingham. He joined the B.T.H. Co. in Birmingham in 1933 where for two years he was engaged on the testing of electric motors before being transferred to the Test Department at Rugby. In 1938 he joined the staff of the Industrial Machines Department as a commercial engineer, but from 1941 to 1943 was assigned to special wartime duties in the Works Order Department. He returned to the Industrial Machines Department and in 1946 moved to the company's Sheffield office. When the B.T.H. Nottingham sub-office was opened in 1953 he was appointed area sales engineer. Mr. Griffiths is a member of the Association of Mining Electrical and Mechanical Engineers.

Mr. James Atherton, of the Trafford Park Works of Lancashire Dynamo & Crypto, Ltd., retired on Friday last after 47 years' service with the company. To mark the occasion Mr. A. J. Beanland, director and general manager at the Trafford Park Works, presented Mr. Atherton with two fireside chairs and a clock on behalf of the works employees.

At a recent meeting of Sub-Area and District managers, the chairman of the East Midlands Electricity Board, Mr. John Mould, presented a set of golf clubs to **Mr. F. H. Pooles,** former manager of the Derby and Burton Sub-Area. Mr. Pooles retired recently after more than 50 years' service in the electricity supply industry. The gift had been subscribed for by his many colleagues and friends throughout the East Midlands Area.

Mr. F. H. Pooles holding one of the set of golf clubs presented to him by Mr. J. Mould (left), chairman of the East Midlands Electricity Board

At its quarterly meeting in London last month the Council of the British Institute of Management elected the **Earl of Verulam,** J.P., as chairman designate. Among his many activities Lord Verulam is chairman of Enfield Rolling Mills, Ltd., the Engineering & Lighting Equipment Co., Ltd., and Sternol, Ltd. He will succeed **Mr. H. Wilmot,** C.B.E., as chairman at the annual general meeting of the Institute on 23rd July.

At the annual general meeting of the Aluminium Development Association held on 18th April **Mr. S. E. Clotworthy,** M.I.E.E., M.Inst.Met., A.F.R.Ae.S., managing director of Northern Aluminium Co., Ltd., was elected president of the Association for 1958-59 and **Dr. M. Cook** (chairman, I.C.I. Metals Division) was elected vice-president. Mr. Clotworthy has served in various capacities on many of the leading organisations of the metallurgical world: at the outbreak of war he was seconded to the Ministry of Aircraft Production, first as deputy director of sheet and strip and then as deputy controller of light metals production. From 1942 to 1946 he was general operating superintendent of Northern Aluminium Co., Ltd., and in 1946 became a director and general sales manager of the company; he was appointed managing director in April last year. Mr. Clotworthy has also served as chairman of the Sales and Export Committee of the Aluminium Industry Council and on the Council of the

Society of British Aircraft Constructors.

The new chairman of the Executive Committee is **Dr. N. P. Inglis** (research director, I.C.I. Metals Division), who succeeds Mr. J. H. Mayes.

The Eastern Electricity Board has appointed **Mr. A. E. Somers** to be senior commercial engineer in the Essex Sub-Area. Mr. Somers was born in 1914 and he served a three-year apprenticeship with the Ilford Electricity Department after education at the Northampton and Borough Polytechnics, London. Later he was with the County of London Electric Supply Co. and served during the war in the Electrical Branch of the Royal Naval Volunteer Reserve, becoming a lieutenant-commander. He returned to the County Company and when the industry was nationalised he became district engineer at Brentwood. In 1954 he was appointed second assistant engineer in the planning and development section of the Essex Sub-Area.

Messrs. W. B. M. Drake and **H. O. Jones,** A.C.A., have been appointed directors of Drake & Gorham, Ltd.

Mr. W. B. M. Drake

Mr. H. O. Jones

Mr. Drake was educated at Eton and served as an officer in the Coldstream Guards. On leaving the Army he worked as a student with R. A. Lister & Co., Ltd., and later studied for two years at Magdalen College, Oxford, graduating B.A. He joined Drake & Gorham in 1951 and has since visited the United States, Canada, West Africa and South Africa on their behalf.

Mr. Jones was educated at Oundle and was articled to a firm of chartered accountants. During the war he served as a pilot with the R.A.F., reaching the rank of squadron-leader before being demobilised in 1946. After qualifying as a chartered accountant, he spent three years with Peat, Marwick, Mitchell & Co. before joining Drake & Gorham, Ltd., in 1952 as chief accountant. He was appointed secretary of the company later in that year.

The annual staff dinner-dance and cabaret of **W. T. Glover & Co., Ltd.,** was held at the Grand Hotel, Manchester, on 12th April. Some 350 people attended this event and the cabaret entertainment was performed by members of the company's Social and Athletic Club, dramatic and operatic section. Among those who attended were Mr. and Mrs. F. Pye, Mr. D. T. Hollingsworth (director and general manager) and Mrs. Hollingsworth, and Mr. S. Winstanley.

Lord Tedder, G.C.B., D.C.L., LL.D. (Chancellor of the University of Cambridge and chairman of the Standard Motor Co., Ltd.), has been elected president of the Institute of Metals.

Mr. S. R. Mellonie, A.M.C.T., M.I.E.E., A.Amer.I.E.E., retired from the electrical industry at the end of April. Since he relinquished his position a year ago as technical engineer, No. 1 Sub-Area (Manchester), with the North Western Electricity Board, Mr. Mellonie has been engaged on special work for the Board which has now terminated.

Mr. Mellonie served an apprenticeship with Crompton & Co., after which he held positions with Metropolitan-Vickers, A. Reyrolle & Co., the Admiralty and the British Thomson-Houston Co., Ltd. His association with the electricity supply industry commenced in 1929 when he joined the Salford electricity undertaking as electro-technical assistant, subsequently becoming (in 1948) deputy city electrical engineer. He was appointed technical engineer of the Manchester Sub-Area of the N.W.E.B. on nationalisation of the industry. Mr. Mellonie was chairman of the North Western Centre of the I.E.E. for 1948-49.

The annual grand ball of the **Electrical Industries Benevolent Association** (Birmingham and District Branch) recently held at the Tube Investments Social Club, Oldbury, was, as usual, well attended. The principal guests were Mr. and Mrs. R. L. Batley and during the course of the evening a competition was held which raised £503 for the E.I.B.A. funds.

Mr. B. French, A.M.I.E.E., chairman of B. French, Ltd., electrical engineers and contractors, of Kidderminster, recently celebrated his seventieth birthday, and to mark the occasion a presentation of his portrait in oils has been made to him by Mr. J. Gower, manager of the Liverpool branch, on behalf of employees.

Mr. A. E. Bird, service engineer with the A.E.I. Lamp & Lighting Co., Ltd., Leicester, is the new chairman of the Leicester Centre of the Illuminating Engineering Society, and **Mr. L. Adrian-Jones** (East Midlands Electricity Board) is vice-chairman.

Mr. W. J. Fulton has been appointed branch administrator at the Belfast branch of Philips Electrical, Ltd. Mr. Fulton joins Philips from W. J. Gamble & Sons, Ltd., a Belfast firm of agricultural dairy and electrical engineers.

Mr. O. Thomas, formerly in the Fittings Design Department of Troughton & Young, Ltd., has joined Hiscock, Appleby & Co., Ltd., as chief designer. **Mr. H. J. Squires** takes over the position of southern area representative.

Mr. R. H. Cooke has been appointed a director and general manager of Research & Control Instruments, Ltd., a new company, reference to which is made elsewhere in this issue. Mr. Cooke, who is well known in instrument circles, played a prominent part in organising the British exhibit at the first "Atoms for Peace" Conference in Geneva and serves on the committee of the Nucleonics Section of the Scientific Instrument Manufacturers' Association. Having been associated for many years with non-destructive testing in industry, he is also a founder member of the Society of Non-Destructive Testing.

Mr. R. H. Cooke

Mr. G. M. Newton has been elected to the board of the British Vacuum Cleaner & Engineering Co., Ltd.

Mr. L. C. Simmonds has just retired from the technical staff of the London Electricity Board after fifty years' service. Before nationalisation he was meter superintendent with the Southwark Electricity Department.

A. Reyrolle & Co., Ltd., announces that **Mr. R. S. Lock,** A.C.I.S., A.A.S.A. (Aust.), has been appointed secretary of the company in succession to **Mr. G. J. Dodgson,** who will retire on 31st May after over forty-seven years' service with the company.

Mr. V. L. Turp has been appointed northern sales manager for Ekco-Ensign Electric, Ltd., and he will operate from the Manchester office. Mr. Turp has been with the company since 1948 and has been eastern district manager. **Mr. T. A. Mills** will continue as assistant manager of the northern sales area.

Mr. V. L. Turp

Mr. F. A. Thiel has resigned his position as northern area manager for Ekco-Ensign Electric, Ltd., and has joined Laycock Engineering, Ltd.

There were 780 members and guests at the annual luncheon of the **Institute of Fuel,** which was held on 24th April with Mr. H. McNeil, the president, in the chair. Before proposing the toast to the guests he presented the first Bone-Wheeler Medal and a prize of £50 (donated by the National Industrial Fuel Efficiency Service),

which is open to candidates under 33 years of age, to Mr. A. M. Freedman for his thesis on "Experience with the humidification of combustion air to prevent boiler fouling." He also handed over past-presidents' badges to Sir William Larke (by proxy in view of his indisposition) and Lord McGowan. An education award was, he announced, to be set up in memory of the late Dr. G. E. Foxwell. Attention was drawn to the forthcoming conference on the use of small coal, which had become an acute problem with increasing mechanisation of mines.

Responding for the guests, Sir Lionel Fraser (chairman, Babcock & Wilcox) gave an account of what was implied in the term "the City" (the square mile between St. Paul's and Liverpool Street), where he had been engaged since his 16th birthday.

The April competition of the **A.S.E.E. Golfing Society** was held at the West Herts Golf Club. Mr. H. Lockett was the winner with 36 points and Messrs. C. E. Furness and E. A. Lampton were joint runners-up. A collection for the E.I.B.A. raised £3.

OBITUARY

Mr. D. S. Riley.—The death has occurred at Richmond (Yorks.), of Mr. David S. Riley, A.M.(S.A.)I.E.E., A.M.I.E.(Aust.), joint managing director of Riley & Neate, Ltd., electrical contractors. Mr. Riley was educated at Burnley Technical College and received his practical training with the Nelson Electricity Department. During the 1914-18 war he served in the Royal Engineers, returning to Nelson in 1920 as assistant engineer. In 1922 he was appointed assistant construction engineer with the Victoria Falls & Transvaal Power Co., and two years later became transmission line engineer with the Government of Tasmania. He returned to this country in 1926 as assistant construction engineer with the Yorkshire Electric Power Co. and in 1928 was appointed deputy chief construction engineer, Shannon power development, Eire. From 1930 to 1934 he was divisional construction engineer with Pirelli-General Cable Works, Ltd., and in 1934 commenced his association with Riley & Neate, Ltd.

Mr. T. W. Harwood.—The death is reported of Mr. Thomas William Harwood, Hon.M.A., formerly registrar of the Manchester College of Technology. He was sixty-nine years of age. Mr. Harwood retired in 1954 after fifty-one years' service at the college.

WILLS

Mr. C. G. Morley New, C.B.E., M.I.E.E., Electricity Commissioner, 1935-48, and member of the South Eastern Electricity Board, 1948-55, who died on 10th December last, left £13,325 gross (£13,205 net).

Mr. J. J. Hambidge, chairman of the British Vacuum Cleaner and Engineering Co., Ltd., who died on 9th December last, left £21,396 gross (£18,927 net).

East Midlands Reorganisation

Board's Policy on Management

IT is the policy of the East Midlands Electricity Board to have two levels of management only throughout its Area. Hitherto the Board has tried the method of enlarged Districts directly responsible to Headquarters, but it has now been decided that the aim can be better achieved by increasing the number of Sub-Areas. Thus, instead of fourteen or fifteen enlarged Districts there are now to be nine Sub-Areas with a possible two further ones later. Ultimately all the Districts will be "double-headed," i.e., there will be no manager but each will have an engineer and a commercial officer in charge of their respective spheres and responsible to the Sub-Area manager.

The Sub-Areas not immediately affected by the alterations are Lincolnshire, Northamptonshire, Nottingham and Coventry, which already has a double-headed District in Leamington. The Derby and Burton Sub-Area is to continue as at present, except that Burton has been made a double-headed District. Uttoxeter will continue under Mr. A. McGregor as District manager. The former Mansfield and North Nottinghamshire District has become a Sub-Area, and Worksop has been reconstituted as a double-headed District.

In place of the existing Derbyshire and Nottinghamshire Group of Districts a new Sub-Area is to be created; it will be based on Ilkeston and will consist of the present Chesterfield, Ilkeston and Matlock Districts.

The Leicester Sub-Area will be enlarged by the addition of the Loughborough District and part of the Hinckley District lying to the south and west of Leicester. The Loughborough District will be double-headed. The enlarged Sub-Area will begin to operate from about 1st July. The Leicester and Warwickshire Sub-Area will continue as at present, except for the transfers to the Leicester Sub-Area mentioned.

These changes involve a number of new appointments. Mr. F. Overstall, manager of the Burton District, has become manager of the Derby and Burton Sub-Area. The manager of the new Ilkeston and North Derbyshire Sub-Area will be Mr. I. A. A. Macdonald, manager of the Ilkeston District. The commercial officer will be Mr. A. E. Heesom, the secretary-accountant Mr. F. J. Godfrey; the engineer is to be appointed. Mr. C. G. Bloore will be responsible for both Matlock and Chesterfield Districts. On or about 1st July Mr. J. Lightbown, manager of the Lincoln District, will be transferred to the Nottingham Sub-Area to assist the Sub-Area manager, Mr. M. Wadeson. Mr. W. W. Grimes, manager of the Chesterfield District, will succeed Mr. Lightbown at Lincoln on or about 1st July. When Mr. F. C. R. Roberts, the present manager of the Spalding District, retires on 30th September, Spalding will become a double-headed District.

Mr. D. C. Whyte, the manager at Loughborough, will be transferred to the Leicester Sub-Area in July to assist the manager, Mr. D. H. Parry. Mr. A. Latham has been appointed manager of the new Mansfield and North Nottinghamshire Sub-Area; Mr. K. M. Briggs will be the engineer, Mr. K. B. Tew commercial officer and Mr. C. H. Turton secretary-accountant.

Mr. A. Elder, formerly group engineer of the Derbyshire and Nottinghamshire Districts, became regional engineer on 1st April. He will be responsible for the co-ordination of all engineering functions in the region consisting of the Derby and Burton, Ilkeston and North Derbyshire, Mansfield and North Nottinghamshire, and Nottingham Sub-Areas.

In a message published in the *East Midlands Electricity Journal* (from which the foregoing information has been extracted) Mr. John Mould, chairman of the Board, says that he is well aware that changes cannot be made without causing some personal problems, but he assures the staff that each will be dealt with sympathetically and on an individual basis. In the expanding electricity supply industry there is no lack of opportunity and there need be no fear for the future. He emphasises that all the changes have been made to produce a better organisation.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £178 5s 0d
Fire Refined 99·70%	ton £177 0s 0d
Fire Refined 99·50%	ton £176 0s 0d
COPPER Tubes ..	lb 1s 8½d
Sheet	ton £205 5s 0d
H.C. wire and strip ..	ton £225 5s 0d
LEAD, English ..	ton £74 10s 0d
Foreign	ton £73 0s 0d
MERCURY	flask £76 10s 0d
TIN, block (English) ..	ton £732 15s 0d
ZINC, G.O.B. Foreign	ton £63 5s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 1s 5½d
Sheet	ton —
Wire	lb 2s 3½d
PHOSPHOR BRONZE Wire	lb 3s 6d
PLATINUM	oz £26 15s 0d
RUBBER, No. 1 R.S.S. spot	lb 21¼d—21¾d

OVERSEAS ELECTRICAL TRADE

Exports for the First Quarter of 1958 Show an Improvement

THE value of British electrical exports in March showed a recovery after the seasonal fall in February, but the total was still a little below that for March, 1957. Exports in March this year were £20 million, as compared with £18·3 million in February, and £20·2 million in March last year. The total value of £58·3 million for the first quarter of this year, however, is nearly £2 million better than for the corresponding quarter of 1957. As compared with March last year, there were small increases in exports of heavy electrical machinery, the generating sets, generators and motors group rising from £3,374,045 to £3,476,016, and the converting machinery, mercury-arc rectifiers, transformers, etc., section from £2,560,884 to £2,670,661. Telegraph and telephone equipment also improved by about £200,000 as compared with March last year. Exports of radio and associated equipment remained at about the same level, but there was a noticeable fall in exports of electric cable, wire, etc., the total

TABLE I.—ELECTRICAL EXPORTS

Class	Month of March, 1958	Three months ended 31st March, 1957	Three months ended 31st March, 1958
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	141,428	470,536	398,394
Ditto, 10 to 65 kW	204,397	475,703	567,358
Ditto, 65 to 200 kW	259,701	301,956	664,790
Ditto, over 200 kW	513,593	940,894	1,049,413
Spark ignition engine driven	11,640	44,219	43,028
Steam turbine driven	104,646	189,183	262,697
Hydraulic turbine driven	—	—	—
Other prime mover driven	6,993	38,894	36,701
Generators, not exceeding 200 kW	145,935	494,814	502,498
Ditto, over 200 kW	75,243	245,175	293,333
Parts of generators	682,114	1,303,100	1,890,570
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ½ h.p.	184,980	580,037	463,969
Over ½ but under 1 h.p.	48,118	154,713	183,794
1 h.p. to 250 h.p.	489,348	1,539,186	1,509,221
Over 250 h.p.	114,267	345,501	311,282
Railway, tramway and trolley-bus motors complete and parts of all motors	210,258	481,857	750,339
Motor starting and controlling gear	283,355	963,323	827,085
	3,476,016	8,569,091	9,754,472
Converting machinery	31,387	200,913	121,077
Mercury-arc rectifiers	59,023	115,998	265,545
Transformers for lighting, heating and power (incl. coils):			
Not exceeding 7,500 kVA	619,395	1,844,884	2,100,362
Over 7,500 kVA	465,722	753,720	1,119,326
Switchgear and switchboards (not telegraph or telephone), up to 200 A and 660 V	416,052	930,600	1,389,534
Ditto, other	1,079,082	3,420,376	3,011,101
	2,670,661	7,266,491	8,006,945
Primary batteries:			
Lighting	103,866	306,622	292,838
Radio	304,687	914,884	865,329
Other	39,197	139,114	136,547
Parts (excl. carbons)	42,127	159,117	144,130
Lamps:			
Filament, exceeding 28 V	100,624	255,786	280,099
Ditto, under 28 V	29,816	108,008	87,249
Arc lamps and searchlights	12,277	42,951	49,639
Discharge lamps, fluorescent tubes, etc.	92,265	326,894	275,157
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury arc rectifiers), photo-electric cells, stabilising and cold cathode valves, magnetrons, klystrons	49,535	82,853	98,635
All other	315,269	850,541	1,028,958
Parts (excluding glass bulbs)	14,397	31,001	44,886
Radio and television transmitters	64,679	242,659	143,563
Commercial radio and radar equipment	1,208,129	3,731,390	3,565,748
Domestic radio receivers, mains	97,362	371,713	267,335
Ditto, battery	44,201	180,085	153,876
Ditto, other (incl. car)	16,185	80,111	77,140
Radiograms	31,446	81,455	119,224
Television sets	153,865	189,924	399,169
Public address equipment	120,645	309,829	333,403
Other radio and television apparatus, n.e.s.	51,490	189,495	100,772
Components and parts, n.e.s.	806,202	2,378,335	2,368,843
	2,973,405	8,719,391	8,701,552
Telegraph and telephone installations	813,596	1,951,044	2,736,957
Telephone instruments, separately consigned	238,670	558,263	715,841
Telegraph and telephone parts	752,331	2,613,413	2,295,667
Line apparatus for long distance communication	215,916	252,454	570,241
	2,020,513	5,375,174	6,318,706

Class	Month of March, 1958	Three months ended 31st March, 1957	Three months ended 31st March, 1958
	£	£	£
Cookers	54,255	209,715	166,144
Toasters	29,610	43,273	75,533
Other cooking apparatus	42,017	96,219	114,678
Parts and accessories	56,339	221,263	182,047
Space heating appliances	65,646	117,254	144,805
Water heating appliances	30,363	92,448	78,443
Other heating appliances	59,628	128,530	147,307
Parts and accessories	63,599	187,341	174,998
Irons	69,658	192,693	256,543
Arc welding equipment, a.c.	81,819	184,505	255,224
Ditto, d.c.	22,346	159,829	84,125
Resistance welding equipment	14,213	79,542	42,741
Electric furnace plant	99,632	323,040	253,679
Magnetos, ignition	19,470	96,779	53,173
Sparking plugs	138,882	471,347	437,551
Elec. appliances for aeroplanes, n.e.s.	277,964	773,669	805,847
Ditto, for motor vehicles, n.e.s.	476,551	1,103,846	1,219,560
Ditto, for cycles, n.e.s.	56,511	150,799	165,347
Signalling app. (incl. traffic signals)	169,987	335,722	525,026
Instruments, commercial	164,393	550,618	536,331
House service meters (including parts)	191,718	566,059	524,271
Electro-medical apparatus (not X-ray)	33,525	101,349	109,279
X-ray apparatus (excl. tubes and valves)	91,253	192,041	191,659
Vacuum tubes	42,654	139,056	140,180
Ceiling fans, complete	179,689	320,930	354,052
Desk fans, complete and parts of desk and ceiling fans	21,891	106,132	80,989
Vacuum cleaners	161,480	487,115	440,691
Floor polishers	60,253	250,059	210,994
Food mixers	65,867	138,103	166,229
Hair clippers and dry shavers	37,066	255,731	163,418
Other portable appliances	19,896	88,044	69,415
Parts	92,360	377,955	381,784
Portable elec. tools (not saws) and parts	239,540	667,588	714,203
Cables and wires:			
Telegraph and telephone, submarine	71,968	110,580	198,578
Ditto, other	486,642	3,138,821	1,961,096
Cotton, silk or art. silk insulated	67,016	133,441	148,267
Enamel, glass or asbestos insulated	71,104	303,804	225,501
Paper insulated	829,972	2,391,996	1,917,424
Rubber insulated	503,683	1,745,580	1,641,377
Thermoplastic insulated	202,210	461,466	650,060
Other	283,500	637,806	806,416
	2,516,095	8,923,494	7,548,719
Accumulators for motor vehicles	196,837	432,818	448,613
Ditto, traction	31,314	84,967	74,971
Ditto, radio and other portable	53,357	266,313	164,146
Ditto, other	36,008	86,710	88,875
Parts and accessories	118,244	283,176	341,731
Electric wiring accessories	148,372	132,398	374,715
Elec. porcelain, etc. (incl. insulators), n.e.s.	87,069	344,719	294,694
Insulating cloth and tape	59,585	187,880	157,798
Other insulating material	106,894	282,098	294,236
Permanent magnets	57,061	145,134	158,680
Radio, telegraph and telephone testing equipment, n.e.s.	99,735	176,059	207,168
Scientific elec. instruments (not telegraphic or telephonic):			
Time recorders and time switches, complete	28,042	29,167	86,798
Other	352,345	941,328	1,003,947
Electrical machinery, n.e.s.	74,345	210,331	229,140
Electrical apparatus and appliances, n.e.s.	941,175	2,641,507	2,698,561
TOTAL	20,002,007	56,560,216	58,351,721

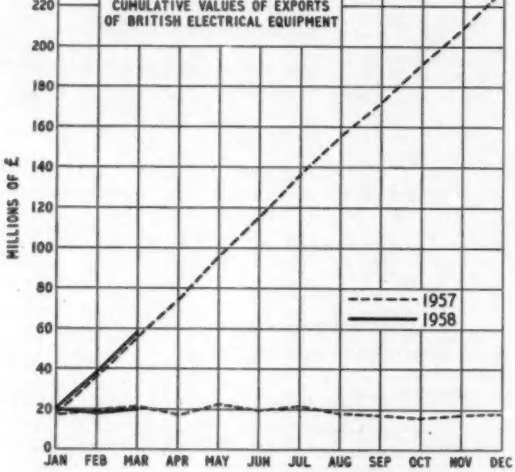
TABLE II.—DISTRIBUTION OF EXPORTS OF ELECTRICAL MACHINERY, APPARATUS AND APPLIANCES

Country	March, 1958	Three months ended March, 1957	Three months ended March, 1958
	£	£	£
Channel Islands	99,068	302,235	297,226
Gibraltar	16,350	33,698	114,823
Malta and Gozo	54,216	141,567	185,545
Cyprus	84,112	417,267	288,216
Sierra Leone	57,135	90,362	175,490
Ghana	185,266	507,658	503,125
Nigeria	451,783	853,946	1,061,154
Union of South Africa	2,035,435	4,391,445	5,473,553
Rhodesia and Nyasaland	455,944	1,564,019	1,465,908
Tanganyika	52,159	199,724	151,357
Kenya	141,309	835,563	442,736
Uganda	91,585	295,828	242,126
Mauritius	51,182	105,190	94,340
Aden	54,518	168,111	173,931
Bahrain, Qatar and Trucial States	127,925	492,563	293,536
Kuwait	216,893	609,285	550,849
India	1,764,231	6,389,667	4,919,936
Pakistan	244,355	951,434	848,313
Singapore	344,955	968,673	982,134
Federation of Malaya	308,648	987,126	921,260
Ceylon	137,170	491,364	384,938
British North Borneo	16,366	68,359	67,169
Sarawak	29,344	48,105	57,193
Hong Kong	320,504	710,864	914,876
Australia	1,639,241	4,861,777	5,199,863
New Zealand	1,283,156	3,111,892	3,990,437
Fiji	20,382	62,875	91,599
Canada	1,006,250	2,891,232	2,763,097
Jamaica	116,314	257,428	408,264
Barbados	35,198	64,368	91,716
Trinidad	127,521	360,789	367,424
British Guiana	52,792	133,408	124,839
Other Commonwealth countries	171,787	366,779	556,974
Irish Republic	325,752	641,723	858,062
Soviet Union	70,791	533,098	129,760
Finland	77,438	286,326	426,669
Sweden	518,341	1,017,487	1,380,451
Norway	240,264	613,919	688,382
Denmark	199,819	631,024	574,639
Poland	68,535	108,917	257,861
Western Germany	260,158	653,614	679,054
Netherlands	578,745	2,113,655	1,841,898
Belgium	317,385	977,293	921,505
France	629,356	1,268,456	1,363,302
Switzerland	155,098	378,130	419,421
Portugal	309,873	768,754	1,258,772
Spain	167,528	1,102,346	554,345
Italy	264,458	947,076	864,239
Austria	50,752	95,310	136,174
Yugoslavia	52,772	186,320	150,015
Greece	70,007	525,603	307,973
Turkey	178,064	176,120	335,129
Belgian Congo	44,843	138,433	117,097
Portuguese East Africa	37,924	94,596	74,018
Egypt	173,913	816	314,691
Libya	51,842	124,193	157,206
Southern Morocco	17,861	134,702	75,754
Sudan	64,333	319,723	246,719
Syria	21,662	117,539	66,046
Lebanon	55,953	103,503	208,127
Israel	65,003	194,612	226,295
Jordan	127,158	183,682	282,108
Saudi Arabia	80,501	162,654	265,142
Iraq	260,127	823,405	907,702
Iran	227,660	924,599	957,483
Burma	76,839	152,029	238,925
Thailand	125,931	260,372	521,072
Indonesia	79,325	183,390	149,499
Japan	58,573	232,575	139,120
United States of America	703,799	2,317,488	1,848,569
Cuba	124,914	120,346	321,394
Mexico	38,558	166,188	156,083
Colombia	49,168	134,724	163,444
Venezuela]	261,450	888,600	1,175,690
Peru	42,497	203,481	117,588
Chile	31,511	128,941	96,656
Brazil	63,950	232,063	326,554
Uruguay	1,033	69,912	11,873
Argentine Republic	376,539	299,236	834,575
Other foreign countries	410,910	1,088,222	1,000,693
TOTAL	20,002,007	56,560,216	58,351,721

value last March being £2,516,095 (against £3,310,343 in March, 1957).

The leading markets in March for generating sets, generators and motors were South Africa (£350,322), Canada (£321,100), Australia (£312,469) and India (£303,335), while in the converting machinery, mercury-arc rectifiers, transformers, etc., group, shipments to South Africa totalled £599,879 and to India £537,148.

France was the best market for radio equipment, importing apparatus valued at £347,922, other important purchasers being Sweden (£235,449) and the Netherlands (£211,202). Australia headed the list for telegraph and telephone equipment with purchases of £330,955, followed by South Africa with a total of £281,820. A notable advance outside the Commonwealth occurred in the shipments to Portugal, which rose from £73,865 in March, 1957, to £181,022 this year.



The fall in the value of exports of electric cables and wires was largely due to the reduced demand from the United States, the value of exports to that country in March amounting to only £11,468, as compared with £413,873 for the corresponding month of last year. India was easily the best market for cables, taking supplies valued at £520,433; New Zealand held second place with a value of £297,163, while South African purchases rose from £80,914 in March, 1957, to £146,317 in March last. Details of exports are given in Table I, while Table II indicates their destinations.

Other electrical equipment shown in the Board of Trade returns includes the following:—

Electric locomotives: March, £150,285; three months (January-March), £684,328 (against £932,904).

Locomotives with i.c. engines and electrical transmission: March, £134,070; three months, £455,908 (£325,062).

Electrically-operated washing machines, complete, not exceeding 150 lb net weight: March, £390,363; three months, £1,079,747 (£947,372). Ditto, 150-250 lb: March, £93,287; three months, £230,001 (£320,753). Parts: March, £62,278; three months, £188,087 £177,286).

Welding electrodes: March, £130,837; three months, £378,363 (£362,116).

Electric conduit tubes and cased tubes: March, £75,780; three months, £184,460 (£284,657).

Electric carbons (including parts): March, £52,557; three months, £155,837 (£284,657).

Electric lighting fittings and lanterns (excluding arc lamps, searchlights, and lamps for road vehicles): March, £262,666; three months, £795,997 (£641,425).

Other electric lighting appliances (excluding vacuum tubes and lamp bulbs) and fittings and parts, n.e.s.: March, £72,191; three months, £327,236 (£789,485).

Electrical imports in March amounted to £2,341,837, as compared with £2,134,842 in February and £1,865,761 in March, 1957. The total for the first quarter of this year was £6,894,255 (against £6,092,577).

VIEWS on the NEWS

By REFLECTOR

THE B.B.C. has been televising a *News Chronicle* competition in which the entrants were required to show how they would spend £5,000 in developing their businesses or starting new ventures. Four men in the penultimate "heat" were given £100 each and in the final stage last week they were required to explain how they had spent it. One of them, Mr. J. Butterfield, started by saying that he had bought an electric cooker to replace his old gas one and he "didn't know that food could taste so good." After this I was sorry that he did not secure the £5,000. However, the man who did, Mr. Niels Svendsen, proposed to use the prize to expand his business of domestic appliance manufacture; his main product is an electric clothes dryer.

* * *

Writing to the *Manchester Guardian*, a lady says that the Budget reduction of duty on wines has not been fully passed on to the buyer because of advances in price "which otherwise would have been made soon." She asks:—

> "How soon will it be before we hear that the manufacturers of refrigerators and washing machines, etc., greatly regret that only a fraction of the tax reduction can be passed on to the public as by a curious coincidence price advances were already in hand?"

I hope that her insinuation of sharp practice will not be justified. Manufacturers should benefit from increased sales resulting from the reduction of tax and to "cash in" otherwise would leave a nasty taste in customers' mouths. No doubt there are possible arguments in favour of sharing the benefit with the customers. For instance, some manufacturers may say that because of tax loading they had been forced to cut their prices to the bone so as not to frighten potential customers off. But on the whole it will be better if the whole of the tax reduction is passed on.

* * *

Such items as the following justify the description of the "Personal" advertisements in *The Times* as the "Agony Column":—

> "Croupier, Astronomer, Pianist, Interpreter, 30, single, four universities, no degree, four years' bitter experience as electronics engineer, seeks worthwhile post, London or warm climate preferred."

How does a croupier drift towards the electronics industry? Perhaps by way of "Ernie," the premium-bond selector. The advertiser's bitter experience indicates that he lost in this particular gamble.

* * *

A great deal of money has been spent by various Belgian authorities in the organisation of the Brussels Exhibition and, naturally, they are hoping to recoup themselves during the next six months. I suppose that, as taxpayers, hoteliers are entitled to participate in this endeavour, but some of them are endeavouring too hard. Again, I understand that the electricity bill for the British electrical and allied display in the Industrial Pavilion, originally estimated at about £600, is now likely to be nearer £4,000. No doubt the electricity supply authority has had to expend a great deal of money on the arrangements for serving the exhibition. But much of the equipment will be recoverable and anyway the authority should be amply repaid by charging something less than the 5d per kWh which, I am told, is the present rate.

* * *

Hinkley Point, Somerset, is now the scene of tremendous activity; a 500 MW nuclear power station is being constructed there by the English Electric Co. and its associates. A correspondent to *English Electric and Its People* says that the district has a very early connection with electricity. About twelve miles from the power station site, at Broomfield, there lived Andrew Crosse (1784-1855) an electrical experimenter. In the grounds of his house he set up a network of more than a mile of copper wires, strung on poles fixed in the trees, and these wires were connected with a battery of [Leyden?] jars in what had once been the mansion's music room. His experiments in "collecting" atmospheric electricity did not commend him to the local farmers, who accused him of causing thunderstorms. The correspondent further says that Crosse addressed British Association meetings. His experiments included therapeutic applications of electricity, attempts to keep fish from putrefying, to render sea-water drinkable, to improve cider in the making and to improve tanning processes.

* * *

Eighty years ago Mr. (later Sir William) Preece suggested the adoption, "for the purposes of practical telegraphy," of the "milliweber" as the unit of electric current. An article by M. Rothen, Assistant Director of Swiss Telegraphs, opposing this suggestion appeared in the *Electrical Review* of 1st May, 1878. Mr. Rothen said that "with the volt, the weber, the ohm and the farad we possess a complete system of absolute electrical units, based on the centimetre-gramme-second." With these, he went on, there were the "derived" units prefaced by *mega* (million) or *micro* (millionth) and he objected to any intermediate steps. He preferred to say 14,000 microwebers to 14 milliwebers. All this seems rather archaic now, but my readers will notice that the weber was the accepted name for the unit of current. It was not until 1881 that the ampere replaced it. In 1889 "weber" was rejected as the name for a practical unit of magnetic flux equal to 10^8 c.g.s. units, but in 1894 it was adopted in America for the c.g.s. unit itself; later (in 1900) it was re-named the "maxwell." To-day the weber is a practical unit of flux equal to 10^8 maxwells. I am indebted for this historical information to *Roget's Dictionary of Electrical Terms* (Pitman).

INDUSTRIAL NEWS

Holiday Pay for Cable Makers

The agreement on holidays with pay operating in the electrical cable making industry provides for the payment of normal time rates on a 44-hour week basis in respect of the holiday period. Last year the trade union side of the industry's Joint Industrial Council submitted a claim proposing the payment of "average earnings" instead of the standard rate, although they were willing that the 44-hour week should remain the basis. It was maintained that adult male workers received, under the present arrangement, 60s a week less for a week's holiday than they would get for a normal week of 44 hours.

As the employers' side of the J.I.C. could not accede to the claim the trade union side notified the Minister of Labour of the dispute and he referred it to the Industrial Disputes Tribunal. In the course of the proceedings the trade union representatives submitted that, as in nearly all other industries where incentive payments formed a large percentage of the weekly earnings, basic time rates in the cable making industry were extremely low and thus the workers concerned were penalised by being paid time rates only during their holidays.

The employers' reply was that the majority of collective agreements in the principal industries and the majority of Statutory Wages Regulation Orders provided for the payment in respect of holiday periods of normal time rates, exclusive of piece-work or incentive bonus earnings and overtime payments. In some respects the present system was more generous than in some other industries.

The Tribunal in its award (No. 1075, H.M. Stationery Office, 6d) finds that the workers' claim has not been established. It does, however, say that it is impressed by the disparity between the average earnings and the holiday payments at normal day time rates. It suggests that the parties should jointly consider the feasibility of introducing a scheme which would make an adjustment in this disparity.

A.E.I. Officers' Training Scheme

Associated Electrical Industries has organised a training scheme for officers leaving the Services as a result of recent defence cuts. Prepared in conjunction with the Officers' Association on behalf of the Regular Forces Resettlement Service, it provides a two-year course for between 110 and 180 officers over the next four to five years. The scheme has been designed primarily to equip officers with no technical qualifications for employment in the electrical engineering industry. Pay will be at the minimum rate of £575 per annum during the first year and £650 during the second year of training. Applications for training should be made to the Officers' Association, Windsor House, 46, Victoria Street, London, S.W.1, or to any local office of the Ministry of Labour and National Service and not to A.E.I., Ltd., direct.

New Instrument Company

Research & Control Instruments, Ltd., has been formed, with offices at Instrument House, 207, King's Cross Road, London, W.C.1 (telephone: Terminus 8444). The company will become sole distributors in the United Kingdom for the electronic instruments and scientific equipment hitherto marketed by Philips Electrical, Ltd. (Research and Control Instruments Division). It will assume full responsibility for the maintenance of existing Philips equipment and its field staff will be supported from a new Service Department and stores at 49, Temperley Road, Balham, London, S.W.12 (telephone: Battersea 9166 and 9197). It will, in addition, become the distributor in Great Britain for the industrial X-ray equipment manufactured by C. H. F. Müller A.G., Hamburg, and for Norelco (U.S.A.) X-ray diffraction and spectrographic equipment. The new company has also been appointed sole distributor responsible for the sale and servicing of Mullard electronic measuring instruments and electro-chemical apparatus in the United Kingdom, manufactured by Mullard Equipment, Ltd. Electronic instruments made by Elektro-Spezial A.G., of Hamburg, will also be handled by the new company.

Indian Import Licensing

The *Board of Trade Journal* of 25th April reviews the import licensing policy of the Government of India for the period April-September. In most respects the procedure is unchanged. Applications for licences for capital goods and heavy electrical plant will be considered in three broad categories, viz., (a) Licences against long-term overseas investment; (b) Licences against medium-term credits; and (c) Licences authorising cash payment. The quotas for some items, e.g., fractional h.p. motors, have been increased but for others quotas have been reduced; the latter class includes certain lighting fittings, cable accessories and rubber-insulated cables.

Irish Import Duties

The Government of the Irish Republic has revised its import duties and special import levies. The levies have been removed from vacuum cleaners, hair dryers, food mixers, shavers, domestic washing machines and fluorescent lamps and fittings, which are now subject to a 60 per cent *ad valorem* duty under the full tariff and 40 per cent under the preferential (United Kingdom and Canada) tariff.

Special Television for Bradwell

An order for a television nuclear reactor camera has been placed with Pye, Ltd., for use at the Central Electricity Generating Board's Bradwell atomic power station, to help engineers to inspect the interior of the station's two reactors when they come into operation during 1960.

The first of three Pye TV cameras for exclusive use in the atomic energy industry was put into operation at Calder Hall in 1956. It was 3in in diameter and 40in long and had its own source of illumination. A special cooling system was provided. The second camera, which was designed hurriedly for a special purpose in 1957, led to the development of equipment incorporating facilities for handling objects within the reactor core and it is a camera similar to this which is to be delivered to the C.E.G.B. some time next year.

Luminous Ceiling

Crompton Parkinson, Ltd., has reserved the Library of the Midland Hotel, Manchester, for 29th and 30th April and 1st May for a showing of its demonstration "Modulume" luminous ceiling. Architects, consultants, electrical contractors and representatives of the building industries are attending. "Modulume" ceilings are based upon "New Line" trunking which accommodates all the necessary wiring and from which is suspended the luminous ceiling structure. There are two major forms of diffuser material, based on a 36in module, the most interesting and easily maintained arrangement consisting of rigid arched plastic pans, which may be coloured. The alternative material—corrugated diffusing strip—may be used to good effect in drawing or administrative offices where the decorative properties of the pans are not required.

German Radar Order

Cossor Radar & Electronics, Ltd., has received an order from the Federal German Ministry of Defence for a complete mobile C.R.21 radar installation.

Motor-Car Showrooms

Last Friday motor showrooms were opened by Burton & Deakin, Ltd., at 9, Central Parade, High Street, Orpington. Although the frontage is only 20ft, the overall depth is 110ft. Decoration and design have achieved a feeling of spaciousness, and the floor is raised at the rear to two levels, making possible from the front of the premises an excellent

view of vehicles throughout a large proportion of the length of the showroom. Lighting throughout is fluorescent, and full advantage has been taken of neon signs for advertising effect. Heating is by G.E.C. thermal storage units.

Public Speaking Competition Finals

Ten women and seven men have won their way through to the national finals of the 1958 E.D.A. Public Speaking Competition, and on 14th May they will attempt to win the competition's main awards—the Faraday Silver Challenge Shields. The contests are to be held in the Devon Room of the Connaught Rooms, Kingsway, W.C.2, and visitors are welcome. Competitors will commence to speak at 10.15 a.m. (men) and 2.15 p.m. (women), the results being made known at about 12.30 p.m. and 5.30 p.m. respectively.

Among the judges are Mr. Frank Phillips, B.B.C., and Miss Ester Purvis, cookery expert and author. The present holders of the shields are Merseyside and North Wales Electricity Board (women) and North Western Electricity Board (men). This year's contestants, with their Boards shown in parentheses, are as follows:—

Women's Section: Miss K. M. Williams (South Eastern), Miss J. V. Blick (Southern), Miss A. Anderson (South Western), Miss I. E. Nutter (Eastern), Miss J. W. Dunlop (East Midlands), Miss J. P. Smith (Midlands), Miss J. Jones (Merseyside and North Wales), Miss V. M. Hill (Yorkshire), Mrs. M. Nicholls (North Western) and Miss A. Brown (South of Scotland).

Men's Section: Mr. R. A. Ashton (London), Mr. H. L. Watkins (South Western), Mr. E. G. Savage (East Midlands), Mr. C. G. Green (Merseyside and North Wales), Mr. P. G. Cope (Yorkshire), Mr. R. H. Jones (North Western) and Mr. J. Potter (South of Scotland).

Plant for Mozambique

A firm of agents, Radio Colonial, Lda., P.O. Box 1086, Lourenço Marques, Portuguese East Africa, is desirous of obtaining particulars of plant in connection with an invitation to tender from a municipality. The plant consists of a 150 kVA i.c. engine generating set and a 40 kVA 380/6,000 V indoor transformer with ancillary equipment. Interested British manufacturers can obtain full details from the firm.

Shoplighting Booklet

A new 32-page "Shoplighting Handbook" to support its range of shoplighting equipment has been produced by the A.E.I. Lamp & Lighting Co., Ltd. The handbook briefly outlines rules of display lighting and devotes sections to lighting techniques for shop windows and interiors. It lists the ranges of A.E.I. "shop and display" lighting available and other A.E.I. catalogues dealing with equipment suitable for shop and display lighting. Illustrations include self-explanatory diagrams and detailed sketches of methods of applying lighting to different situations. The handbook also lists the illumination levels needed for shop windows in various districts.

Motor Price Reductions

Crompton Parkinson, Ltd., announce that as from 1st May new prices, on average 8 per cent lower, are being adopted for industrial a.c. electric motors of the totally enclosed fan-cooled type. These motors, with outputs up to 20 h.p., are built to British Standard No. 2083 and form a very large proportion of industrial machine drives. Two months ago reductions averaging 8½ per cent were made in the prices of industrial a.c. ventilated motors up to 40 h.p., built to British Standard No. 2960.

Cables for Curacao

Power and control cables and accessories for 15 kV, 3 kV and 1,100 V working have been ordered from Siemens Edison Swan, Ltd., for Mundo Nobo power station, Curacao, Dutch West Indies. The contract was placed by the Metropolitan-Vickers Electrical Co., Ltd., main contractors, and includes supervision of installation.

Mechanical Handling

Visitors to the Mechanical Handling Exhibition, which opens at Earls Court, London, on 7th May, will find the two special exhibition issues of *Mechanical Handling*, the monthly journal which organises this important event, useful guides. The May "London Exhibition Preview" issue forms a complete guide to all activities at the Show, and includes a full directory of exhibitors; floor plans; a profusely-illustrated stand-by-stand guide to exhibits; Convention and film programmes, etc. In June *Mechanical Handling* will publish its special "London Exhibition Report" number, providing detailed reports on exhibits and highlights in the Show.

Post Office Underground Railway

Work is now nearing completion on new lengths of tube for the Post Office underground railway. A stretch of line has had to be constructed to serve a new Western district office which is to be built in Rathbone Place, London, W.1. A new station for the railway will also be constructed. The main tunnel is of 9ft. diameter, and will carry a double track. At each side of the new station this divides into two smaller tunnels which will serve the two platforms. Building of the junctions is in progress. The underground station is designed to support the weight of the office that will be built above it. The base of the walls of the station will be of reinforced concrete 13ft 6in thick. The building itself will have six storeys above ground and two below. It is expected that the new office and the railway will be brought into full use in 1963.

Switchgear Exhibition

J. A. Crabtree & Co., Ltd., are holding an exhibition of their products at the Griffin Hotel, Leeds, 1, from 5th to 9th May. They will be exhibiting particularly their types B-15 and B-26 air break contactor gear and type D-6 manual starters together with auxiliary equipment and limit switches. Various control panels and equipment will also be displayed incorporating this gear. Miniature circuit-breakers and industrial wiring accessories will also be on view. Applications for tickets should be addressed to the company at Lincoln Works, Walsall, Staffs.

Illumination Courses

We have received programmes of illumination design courses to be held at the Y.M.C.A. Institute, 10, Bothwell Street, Glasgow, on 6th, 13th and 20th May and at the Scottish Liberal Club, 109, Prince's Street, Edinburgh, on 7th, 14th and 21st May. Further particulars may be obtained from the British Lighting Council, St. Vincent Place, Glasgow, C.1.

Shopper's Guide

The fourth issue of "Shopper's Guide," a quarterly magazine of candid comment issued by the Consumer Advisory Council of the British Standards Institution, is now available. The magazine has been increased in size by 12 pages and the number of subscribers has now reached 25,000.

"Are Cheap Electric Fires Safe?" is one of the questions dealt with and, also of interest, are the results of a questionnaire on electric washing machines. From this it is gathered that only 2 per cent of users would revert to washing by hand methods or the use of laundries.

Descaling a Refinery Tower

While the main 11ft 6in diameter 90ft high column of a refining unit in Trinidad was being erected it was exposed to moist air for about four months and became rusty inside. This coating of rust was stripped by novel means. It had been intended to use pneumatic hammers on the outside of the vessel and wire brushes inside, which would have involved a good deal of expense and time, in the erection of scaffolding both externally and internally on the column, and considerable manual labour. The engineer of Metal & Pipeline Endurance, Ltd., working on cathodic protection schemes for the oil company, Texaco Trinidad Inc., suggested electrolytic descaling.

The tower was filled with water and salt in the requisite proportions and a temporary anode consisting of a steel pipe was suspended on supports insulated from the shell and supplied

with d.c. from a group of welding machines, the resistance of the circuit being suitably adjusted. A high current density was used for this descaling purpose and, within 48 hours, the whole of the rust had been pulled off and dropped to the bottom of the tower leaving clean steel, under a deposit of fluffy white calcareous coating. This was washed off with fresh water from a high-pressure hydrant when the tower was emptied and the surface covered with lubricating oil to prevent re-rusting.

Electronic Equipment for Italy

Winston Electronics, Ltd., has received an order for over £70,000 from Italy for electronic equipment, which includes spectrum analysers and highly stabilised decade oscillators.

Isolators for the B.T.C.

The British Transport Commission has recently placed an order with the Hackbridge & Hewittic Electric Co., Ltd., for the supply of 150 25 kV single pole, three-position outdoor isolators for use in connection with the electrification of British Railways.

Exhibition of Paint Finishes

Donald MacPherson & Co., Ltd., held a technical exhibition of its "Foochow" paints, enamels, varnishes, &c., at the Queen's Hotel, Piccadilly, Manchester, from 22nd to 24th April. Similar exhibitions are to be held from 13th to 15th May at the Griffin Hotel, Leeds, and from 20th to 22nd May at the Black Boy Hotel, Nottingham.

Works Visits

A party of visitors from the Imperial Defence College toured the Barnsley factory of Brook Motors, Ltd., on 21st April. In the party were Brigadier C. I. M. Dunbar, C.B.E., D.S.O. (leader of the party); Mr. R. A. Beaumont, C.M.G., O.B.E. (Foreign Office); Captain H. H. Bracken, R.N.; Air Commodore N. H. Dwyer, C.B.E., R.A.F.; Captain T. N. Howes, D.S.C., R.N.; Captain T. C. Pullen, Royal Canadian Navy; Mr. G. H. Thomas (War Office) and Mr. L. R. Denton (Board of Trade, N.E. Regional Office). They were shown round the works by the directors.

A delegation from the Convention of Public Schools Careers Masters being held in Cardiff recently visited the Blackwood factory of South Wales Switchgear, Ltd. The delegation was shown around the works by Mr. A. J. Nicholas, managing director, and senior members of the staff.

Trade Announcements

To meet the increasing demand for its products in the Birmingham area, **Aerialite, Ltd.,** has acquired larger premises at 248, Barr Street, Hockley, Birmingham, 19 (telephone, Northern 8541/2).

A new service depot for **Morphy-Richards** and Astral appliances has been opened on the Paulsgrove Industrial Estate, Portsmouth, to cover Southern England; the service depot manager is Mr. F. C. Wyatt. At the London Astral service centre, Camden Town, N.W.1, Mr. L. M. Mullord has been appointed service depot manager. The manager of Astral's London storage depot at Leyton, E.10, is now Mr. G. Haynes.

As a result of re-allocation of office accommodation at its head office, 51-53, Hatton Garden, E.C.1, the Engineering Sales Department of **W. T. Henley's Telegraph Works Co., Ltd.,** has moved to 59/62, High Holborn, London, W.C.1.

Langley London, Ltd.—The telephone number of the company's sales office and works at Kelvin Way, Crawley, Sussex, is now Crawley 25955-9.

Cimex-Fraser Tuson, Ltd., manufacturers of electrically operated floor maintenance machines, have recently received SEMKO (Swedish Bureau for Testing Electrical Equipment) approval for their "Mallard" polisher and scrubber and "Dipper" dryer.

Kenwood Electrics, Ltd., distributing company of the Kenwood Manufacturing Co., Ltd., has moved its offices to Dishmaster (London), Ltd., 151, Great Portland Street, London, W.1. Recently the Kenwood Manufacturing Co. completed a merger with Dishmaster (London), Ltd., and its distributing company is now moving its sales offices from the main factory at Woking to London. The new offices of Kenwood Electrics will be under the supervision of Mr. R. Hubbard, area sales manager for Kenwood. Mr. H. Angus will be in charge of internal administration.

Stein & Atkinson, Ltd., have decided to cease the manufacture of rotary and end tilting rotary melting furnaces in order to increase their capacity for dealing with other types of furnaces. Their drawings and designs have been acquired by the **Monometer Manufacturing Co., Ltd.**

Fonadek (Branson), Ltd., Harborne, Birmingham, have moved their London offices from Wigmore Street, W.1, to larger premises at 442, Chiswick High Road, W.4 (Chiswick 8561).

Calendar

Bruce Peebles & Co., Ltd., have sent us a useful calendar for May, 1958, to April, 1959. The large monthly sheets, showing also the preceding and following months, are surmounted by an attractive picture of Cawdor Castle, Nairnshire, Scotland.

Industrialists' Proposals for a Free Trade Area

THE main industrial federations and employers' organisations in Austria, Denmark, Norway, Sweden, Switzerland and the United Kingdom have agreed on the principal features of a European Free Trade Area, to be known as Euromarket. Their recommendations are published in a report, *Free Trade in Europe*, copies of which have been sent to the Governments of all O.E.E.C. countries and also to industrial bodies in the six Common Market countries.

A main point of departure from the official discussions is the suggestion that agriculture and fisheries should no longer be excluded from the Free Trade Area. Special arrangements, it is stated, should be negotiated for the primary products, bearing in mind the problems of individual countries, e.g. the obligations of the United Kingdom towards the Commonwealth, and the need "to secure a reasonable measure of market stability." Industrially processed products from agriculture and fisheries should, however, be treated like other industrial goods. It is also suggested that new institutions should be created to investigate complaints of members contravening agreements and to sanction counter-measures.

The report stresses the importance to manufacturers in the Free Trade Area of having access to basic materials at "fair competitive prices, and the danger of adopting measures that might result in increasing production costs." Definition of origin, it is suggested, should be on the basis of percentage content or application of specific processes or both as appropriate. Among the practices that it is proposed should be governed by "Rules of Competition" are: direct and indirect subsidies, export restrictions, discriminatory dual pricing, cartels and monopolies, dumping and discriminatory State purchases. Public undertakings should be treated on the same footing and work under the same conditions as private enterprise. Governments should not, however, be forbidden from helping an efficient undertaking to convert to another kind of manufacture, or helping a particular area or industry "for reasons of state."

It is considered that greater progress towards the harmonisation of economic and financial policies will be made through the normal process of co-operation than by any attempt at compulsion. There should, however, be a progressive liberalisation of capital movement, coupled with freedom of establishment, and mobility of labour.

Nuclear Reactor Technology

A six weeks' course on "Nuclear Reactor Technology" will be held at the Bradford Institute of Technology from 2nd June to 11th July. The fee for the course will be £30, and application forms can be obtained from the Principal of the Institute.

Cyclone-Fired Boiler

Record of First Year of Operation

EXPERIENCES during the first year's working of the first cyclone-fired boiler commissioned in Britain were described in a paper presented on 25th April before the Institution of Mechanical Engineers by Messrs. R. P. McCulloch, J. R. Willetts and A. Richardson of the Kynoch Works, Imperial Chemical Industries, Ltd., where the boiler is installed.

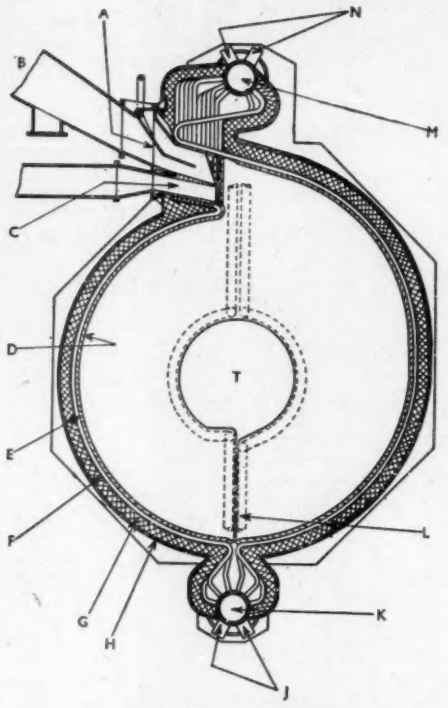
The plant as a whole was described in the *Electrical Review* of 1st November last, and the present paper deals with the operation of the standard radiant boiler (rated at 200 klb/hr at 950 lb/sq in and 925 deg F) from October, 1956, to October, 1957, and the overcoming of earlier "teething troubles." These were largely due to difficulties in maintaining slag flow when milling while the unit was on low loads, but some modifications and developments in operating technique have enabled it to carry loads of 40 per cent provided that below 50 per cent load changes are not too severe.

Thermal efficiency on official test was 88·1 per cent, as against a guarantee of 87·8 per cent. The coal was a Midlands ½in washed slack having a moisture content (as received) of 17·3 per cent, and an ash content of 9·9 per cent; its gross c.v. (received) was 10,210 B.Th.U./lb. If the moisture could be reduced to 12 per cent, the gain in gross thermal efficiency would be over 0·5 per cent. Heat lost in slag quenching water is *pro rata* to the ash content, which should be at least 6 per cent to deposit a protective slag coating on the cyclone walls.

Expensive milling plant is unnecessary since particle size is unimportant and coal is dealt with by a beater mill, 100 per cent passing through a ¼in B.S. sieve and 30·4 per cent through a 200 mesh sieve. Coals of between 30 and 50 per cent ash content have been burned, subject to satisfactory slag viscosity. Any flame-out was followed by immediate re-ignition.

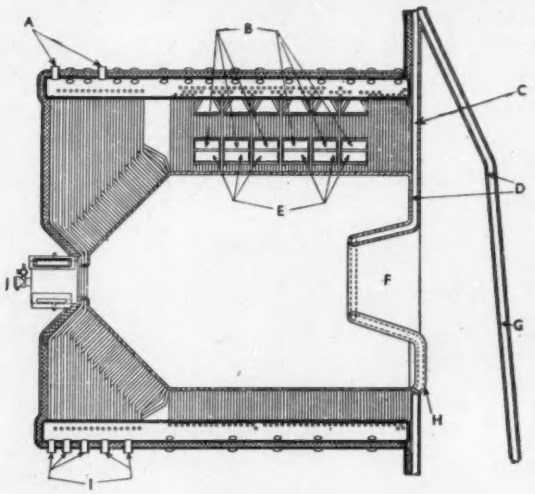
Construction of Cyclone

The single cyclone used is 9ft in internal diameter and 12ft long and the tubes forming its walls are of 1in bore with the water circulation in parallel with other drum thermal circuits. Its construction is shown in the accompanying sectional diagrams. Coal is blown into the boilers in an airstream at 350 to 400 deg F at a velocity of 65 ft/sec. Secondary air at 630 deg F is fed into the cyclone at 370 ft/sec. About 90 per cent of the slag is trapped in molten form in the cyclone, from which it runs through a hole to the floor of a secondary chamber and thence through a discharge chute to a water-filled tank.



Cross-section through cyclone

A. Clapper dampers. B. Secondary air inlet. C. Fuel nozzle. D. Plastic chromium ore on studded tubes. E. Tube. F. Inner casing. G. High-temperature insulation. H. Outer casing. J. Supply pipes. K. Bottom box. L. Slag trap. M. Top box. N. Risers. T. Throat



Longitudinal section

A. Risers. B. Secondary air nozzles. C. Front wall tubes. D. Plastic chromium ore. E. Fuel nozzles. F. Throat. G. Screen tubes. H. Slag tap. I. Supply pipes. J. Lighting-up oil burner

Particles not caught on the slag screen are trapped in the boiler passes and by precipitators.

An air-operated automatic-control system, supervised from the main power station control room by one man, has been developed to maintain constant pressure and temperature steam output at maximum efficiency from 100 to 55 per cent of full load. From 1st May to 1st November, 1957, availability was 94·5 per cent after deducting hours taken for statutory survey.

Kariba Gorge Transmission

Design of 330 kV System for Rhodesia

IN a paper presented on 30th April before the Institution of Electrical Engineers' Supply Section, Messrs. F. C. Winfield, T. W. Wilcox and G. Lyon (Merz & McLellan) described the 330 kV transmission system now under construction for the Federal Power Board of Rhodesia. The system is based on the Kariba Gorge 1,200 MW hydro-electric station being built on the Zambesi River at a total cost of £113 million. Its annual output capacity will be 8,000 million kWh. Main contracts for the first stage of the scheme (estimated to cost £80 million), which includes the installation of six 100 MW Francis turbines (minimum head 232ft) and nearly 900 miles of primary transmission lines, were let in July, 1956, and construction was started in February of last year. Five sets are scheduled for commissioning by September, 1961.

The F.P.B. area is served by two Portuguese ports, Beira and Lourenço Marques, by single-track railways having a permissible out-of-gauge loading of only 3ft 10in, which introduces difficulties in transporting heavy equipment, especially the turbine runners. Special wagons, heavy cranes and road trailers are being purchased. The railhead for Kariba power station is 150 miles from the site and road transport for the heaviest lifts is possible for only three months of the year.

Power Demands

Power from Kariba Gorge will supplement the output of existing thermal stations, which will continue to be owned by four undertakings, but will be under operational control of the F.P.B. These have an aggregate capacity of 670 MW in sets of from 15 to 30 MW and local transmission voltages run from 33 to 88 kV. Total demands, principally for mining and agriculture concentrated in the copper belt in Northern Rhodesia and in the midland zones of Southern Rhodesia, are expected to reach 625 MW in 1960 and 1,467 MW in 1971 and possibly about 3,500 MW by 1980. Additional sources of supply are now being explored.

The choice of 330 kV for the new transmission system was determined by its substantial ultimate financial advantage over 275 and 220 kV (Fig. 2). The alternative of 380 kV was found too expensive in the early stages.

On the score of economy, supplies in the first few years will be given over single circuits. Faults on the 330 kV system are expected to be predominantly between single line and earth and single-pole auto-reclosure will be employed in some cases. Laboratory tests (to be confirmed by field tests) tend to show a de-ionising time of 0·3 sec as ample for 150 miles. The extra cost of intermediate switching stations in lines of 200 to 270 miles would be slightly less than for the corresponding reductions in reactive plant and in postponed line construction while more advantageous in operation and maintenance.

Kariba lies near the centre of one of the worst lightning areas in the world and tower-footing resistances may reach 300 ohms, necessitating the use of counterpoises (7/8 s.w.g. galvanised steel between towers) for values exceeding 20 ohms. To ensure the highest security the lines will be of flat configuration on single-circuit lattice-steel towers with double overhead earth wires. Line insulation level, other than at terminations, is governed mainly by 50 c/s wet-withstand voltage and impulse flash-over voltage and is limited to 1,250 kV by arcing horns at both ends of insulator strings at all line terminations. For transformers and 330 kV substation switchgear the level is 1,350 kV. Type tests have shown the circuit-breakers to give switching over-voltages of less than 600 kV (peak) for both capacitative and low-inductive currents, which is compatible with the performance of surge divertors protecting transformers. All step-down transformers are equipped with on-load regulating equipment (20 per cent range) and tertiary windings for reactive control (20 MVAr).

Transport limitations prevent the conveyance of 120 MVA three-phase transformers required for the generators at Kariba Gorge, so these consist of three single-phase units with a ratio of 191/18/18 kV rated at 80/40/40 MVA

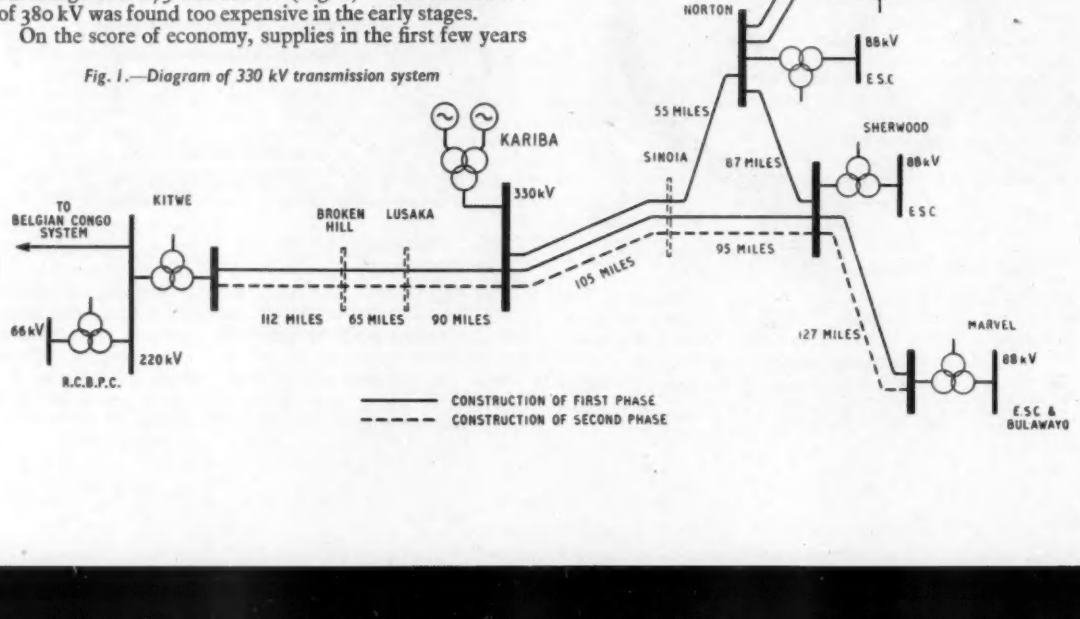


Fig. 1.—Diagram of 330 kV transmission system

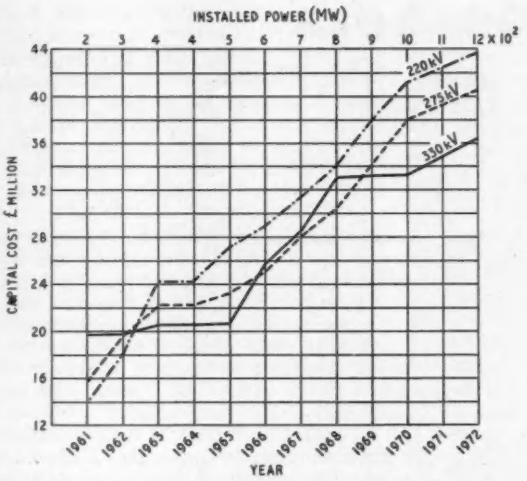


Fig. 2.—Comparative capital costs of transmission systems

and connected in Y/D/D with solidly earthed neutral; connections to the switchgear are by 330 kV single-core oil-filled lead-covered 0·85 sq in cables running vertically for 500ft above the power station. Three-phase Y/Y/D transformers will, however, be used in substations, where ratings will not exceed 60 MVA.

Circuit-breakers are of the bulk-oil lenticular-tank type rated at 7,500 MVA with six breaks per phase, each shunted by a linear resistor with six auxiliary breaks in a novel arrangement (Fig. 3). Rates of rise of restriking voltage for 100 per cent symmetrical and 10 per cent duties are 3 and 8 kV/microsec, respectively. Charging currents up to 300 A and magnetising currents up to 200 A have to be broken without generating excessive overvoltages. For the initial 600 MW stage 20 MVA iron-core oil-immersed shunt compensating reactors will be connected by 11 kV air-blast switchgear to the testing windings of the substation transformers, to which small auxiliary transformers will also be connected to give local 380-230 V supplies.

Steel-Cored Aluminium Conductors

Considerations of transmission capacity, resistance and corona losses, radio interference levels and cost have led to the choice of steel-cored aluminium for line conductors. These consist of two 0·35 sq in (copper equivalent) conductors per phase at 18in spacing. Suspension insulators are single strings of nineteen 10in discs of toughened glass. The standard span is 1,500ft between lattice-waisted towers of high-tensile steel. Stockbridge dampers (four per component conductor per span) are installed as a guard against vibration trouble.

Protection of 330 kV overhead lines is afforded by three-zone high-speed distance mho relays with carrier-accelerated tripping for faults within the second zone. Blocking relays prevent their operation during system instability except at certain points as determined by system analyser studies. For generators and reactors overall differential protection, with definite-minimum inverse-time back-up relays, is employed. Transformer windings are separately covered by balanced earth-fault protection with over-current relays for earth faults. Buchholz relays are also installed on transformers and reactors. Both ends of each 330 kV line are being equipped with high-speed self-locking voltmeters and

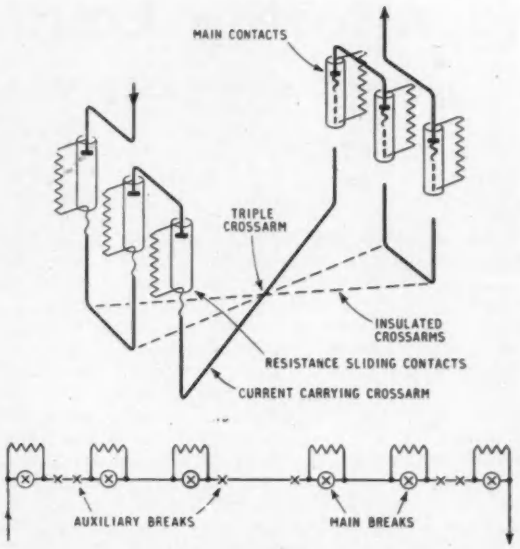


Fig. 3.—Six-break 330 kV circuit-breaker; heavy lines show current paths with breaker closed

ammeters, which record zero-phase-sequence values during the moment between an earth fault and its clearance. Main communication and control is by superimposed power line carrier in conjunction with frequency-modulated voice-frequency telegraphy.

Notes on Brussels

FURTHER particulars have reached us of British firms' activities at the Brussels Exhibition.

Thorn Electrical Industries, Ltd., tell us that their subsidiary, Atlas Lighting, Ltd., has floodlit the 80ft concrete approach to the Canadian Pavilion by means of specially-devised kerb fittings which confine the light to the pathway. Atlas "Display" fittings are used to illuminate a tower constructed of various metals produced in Canada. Other lighting includes fluoreseent fittings and restaurant fittings supplied by George Forrest & Sons, another Thorn company. There are also examples of Thorn lighting in the British Government and Industry Pavilions.

Over 3,600ft of reflector troughing has been supplied for the lighting of the British Industry Pavilion by the A.E.I. Lamp & Lighting Co., Ltd. Fluorescent 5ft and 8ft lamps are employed to light the whole of the underside of the roof without direct downward light. Illumination at floor level is about 7 lumens/sq ft and the lighting load is in the neighbourhood of 50 kW. The company also supplied other lighting equipment, including "Satina" fittings, for other parts of the British Section.

For sale at its exhibit the B.B.C. has prepared a well-illustrated brochure outlining its activities, including the overseas service and its part in "Eurovision."

From their stand in the British Industry Pavilion Babcock & Wilcox, Ltd., are distributing an attractive trilingual (English, French and German) booklet containing many illustrations (some in colour) and brief details of their work in a number of fields. A separate drawing of the Hinkley Point 500 MW nuclear power station is included and there is a detachable postcard showing the station in course of erection.

Monitoring Loudspeakers

Discussion on Quality and Design Criteria

By D. E. L. SHORTER, B.Sc.(Eng.), A.M.I.E.E.*

THE subject of high-quality loudspeakers in general is not easy to discuss constructively because of the wide divergence of individual taste and judgment among the potential users. In the case of loudspeakers used for monitoring purposes by broadcasting and recording organisations, however, the terms of reference are fairly well defined. Here, the " customers " are in fact trained staff, whose daily work gives ample opportunity for comparing the reproduced sound with the original, and whose ideal is accuracy both in detail and in overall effect. Complete realism in reproduction by a single loudspeaker is not, however, possible, even in theory, and the characteristics required to give the best approach to the ideal cannot be prescribed from first principles.

Aural judgments of sound reproduction, unless made under carefully controlled conditions, can easily produce inconsistent results. An example of the pitfalls to be avoided in loudspeaker testing is the use of multi-microphone arrangements producing effects which are not audible to an observer in the studio; in such cases it is impossible to make a fair comparison between the original and reproduced sounds. Again, the bass response of a loudspeaker depends to some extent on its location in the listening room and this position may have to be varied to obtain a representative result.

Optimum Frequency Characteristics

It is difficult to apply the frequency characteristics of a loudspeaker measured in free air to practical working conditions in a live room, where much of the sound reaches the listener after being radiated in various directions and reflected from the walls, floor and ceiling. Since the frequency response of a loudspeaker varies with direction, the overall result, as judged subjectively, must be represented by some kind of composite frequency characteristic. Attempts have been made to predict this characteristic by introducing the concept of " mean spherical response "—analogous to the " mean spherical candle power " in optics—but no universal formula has yet been devised. With loudspeakers of conventional construction, the nearest approach to realism is often obtained when the low-frequency response measured on the axis is uniform or even rises slightly at the bass; a flat " mean spherical response " usually gives a very " thin " effect.

There is still no general agreement as to how smooth the frequency characteristics of a loudspeaker need to be. A few workers have investigated the relationship between the detailed variations in response with frequency and the behaviour of the system when a transient signal is applied; as a result, some progress has been made in formulating empirical performance criteria. However, there remains a number of observed effects which cannot be completely accounted for by the frequency characteristics and it will probably be necessary in future to pay more attention to the phase characteristics of loudspeakers, a subject which has been somewhat neglected in the past on account of the instrumental difficulties involved in the measurements.

Design Considerations

Although cone loudspeakers have been in common use for more than three decades, their design is still a matter of trial and error and the results obtained are frequently disappointing; many of the smaller units in particular exhibit objectionable coloration in the lower middle-frequency range and give a " woolly " or " throaty " type of quality. " Tweeter " units for the high-frequency range have received much attention in latter years and numerous refinements, varying from the substitution of plastics for paper pulp as a diaphragm material, to the use of a modulated radio-frequency glow discharge in air as a source of sound, have been tried. One of the simplest

* B.B.C. Research Department.

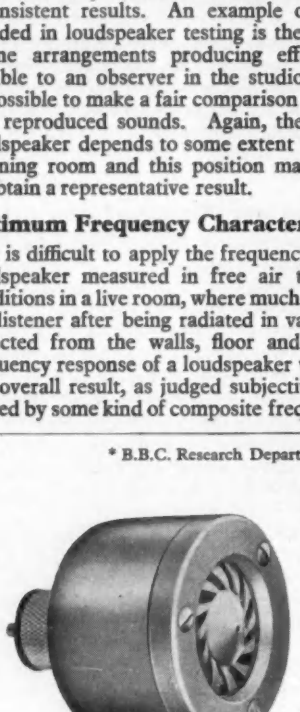


Fig. 1.—Example of modern direct radiator high-frequency unit

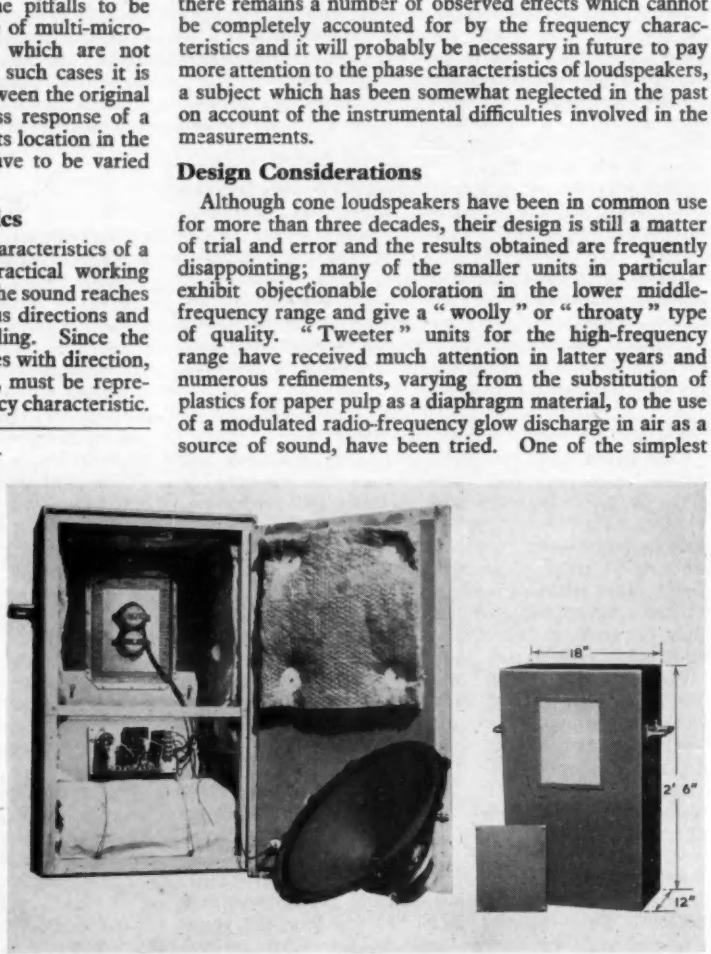


Fig. 2.—Portable loudspeaker with high-frequency units mounted on perforated baffle

and most successful types of high-frequency unit resembles in form the so-called "pressure" system of a horn loudspeaker, but is designed for direct radiation. Fig. 1 shows a commercial unit of this kind, having an overall diameter of only 2½in. Because of the small dimensions, the radiation from these units is less directional at high frequencies than that from a simple cone or horn loudspeaker. Small high-frequency units can be located in the mouth of the associated low-frequency unit; in these circumstances their performance can be improved by mounting them on a thin metal plate which is perforated over part of its area to allow low-frequency sounds to pass. Fig. 2 shows two views of a portable loudspeaker employing this arrangement developed by the B.B.C.

Both the low-frequency response of a loudspeaker and the damping of its fundamental diaphragm resonance depend on the efficiency, as manifested in the motional impedance of the speech coil, and on the output impedance of the driving amplifier. Any increase in motional impedance or decrease in amplifier impedance gives greater damping, but this process, if carried beyond a certain point, causes the low-frequency response to fall; as a result, it may be desirable, in some cases, to introduce bass correcting networks into the associated power amplifier equipment.

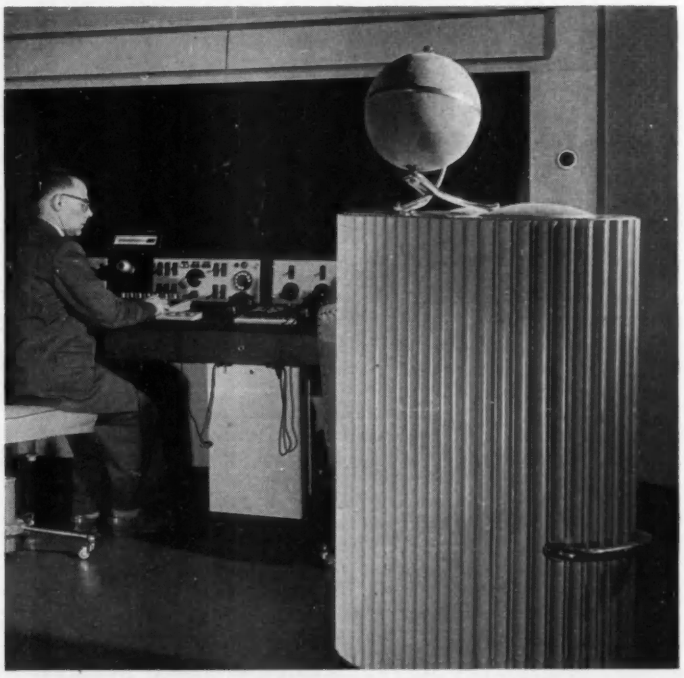


Fig. 3.—"Omnidirectional" loudspeaker employing twelve high-frequency units

In spite of much ingenuity, loudspeaker cabinets have remained essentially unchanged in their geometry for the past two decades and seem likely to remain so; there is, however, scope for research on materials. Unwanted sound radiated from the rear of the loudspeaker diaphragm can still escape through the cabinet walls unless these have adequate mass, stiffness and damping; careful control of the last-named quantity enables economies to be effected in the other two.

Future Trends

With a few possible exceptions in the field of stereophony, high-quality loudspeakers of the future will probably be much less directional than those to which we are now accustomed. One of the most thorough-going attempts ever made to minimise directional effects is illustrated in Fig. 3, which shows a loudspeaker developed by the German broadcasting authorities. A low-frequency unit, mounted in the top of its cabinet, is supplemented by twelve small cone units mounted in spherical formation; in a later version, the number of low-frequency units was increased to three, one at the top of the cabinet and two at the sides, and the number of high-frequency units to thirty-two. Full-range electrostatic loudspeakers which have lately been under intensive development will probably be in increasing evidence in future. In the matter of cost they have a potential advantage over loudspeakers of conventional type as it is possible to dispense with the cabinet. Future development on these lines may eventually enable the quality of domestic sound reproduction to be raised, without undue expense, to a standard comparable with that required for monitoring purposes in the studio.

In preparing this article the author has made use of some of the information and diagrams in his paper entitled "A Survey of Performance Criteria and Design Considerations for High-Quality Monitoring Loudspeakers," which was first published by the Institution of Electrical Engineers as Paper No. 2604R in April, 1958, and will be republished in Part B of the I.E.E. *Proceedings*.

DISCUSSION

The discussion was opened by Dr. G. F. Dutton, who said that those concerned with gramophone recording had concluded that the aim should be a smooth characteristic up to 12 or 15 kc/s on the axis of a reasonably good spherical rotation characteristic and that direct radiator cone loudspeakers were preferable to horn-driven types, probably for a number of small reasons rather than one particular one. Most "hi-fi" enthusiasts played loudspeakers at a level several dB higher than the record companies or broadcasters intended, whereas the correct balance could be upset by playing even a few dB higher. The full effect of an orchestra *in forte* could not be obtained unless the level was up to its full original.

Mr. G. A. Briggs did not agree with the author's suggestion for the use of smaller magnets and bigger amplifiers. A high-flux loudspeaker always sounded brighter and cleaner than a low-flux one and this had to be paid for. The root of the trouble lay in the obsession with high damping factors and constant volts. Why should not response curves be taken on constant current or on a mixture of the two to suit the loudspeaker? A high damping factor put a brake on the performance of the best models.

Mr. F. H. Brittain agreed that the polar response was about as flat as one could get it axially. It should be not more than 5 dB down at 10,000 c/s and an off-axis angle of about 30 deg. If that were obtainable at all frequencies without peaks, the result would be acceptable.

Mr. J. Moir remarked that the author's work confirmed the finding of Kaufmann that a loudspeaker ought to have about the same polar diagram as the source. A difficulty was to get a loudspeaker which suited both a violin and a symphony orchestra. One did not want a flat mean spherical response, but a polar diagram like that of the original instrument.

Heat and Power in Western Europe

IN his presidential address to the Institute of Fuel on 23rd April, Mr. H. McNeil (Babcock & Wilcox) outlined the main factors affecting fuel requirements and the supply of fuel for the next 10 to 20 years in Great Britain, France and Germany. Irrespective of present consumption in any country, the doubling of electrical demand every decade (averaged over the past 70 years) was, he believed, likely to continue. The rate of growth was partly accounted for by growing domestic demand, but was mainly due to industry through the replacement of muscle power and even more through the obtaining of results otherwise impossible. Direct uses for electricity in large quantities, as in the electro-chemical and electro-metallurgical industries, were also likely to increase.

Improvements in steam-cycle efficiency had also been progressive, notably through the use of higher steam pressures and temperatures and of regenerative feed heating and steam reheating. Both the last two dated from 1921 when North Tees power station, the pioneer of the present design of steam cycle, was commissioned. However, only when individual boilers were large enough to match the steam demand of one turbine each were the complications of the reheat cycle considered to be outweighed by its higher efficiency.

Within the next ten years the thermal efficiency of new plant would probably rise to 40 per cent (corresponding to an annual reduction of 2 per cent in fuel consumption) compared with the best British result in 1956-57 of 31·52 per cent, and all pre-war units would then be out of service. This gave an increasing fuel demand for electricity generation of 5 $\pm$0·5 per cent per annum (compounded), which would be applicable to France and Germany also.

Total fuel used for this purpose, based on the lower margin referred to, showed an increase for Britain from 44·8 million tons in 1955 to 69 million tons by 1965 and 107 million tons by 1975. France used 24 million tons in 1954 and taking into account that 40 per cent of electricity requirements came from hydro-electric sources, the fuel required (in coal equivalent) would reach 40 million tons in 1965 (including 17 million equivalent from water power); by 1975 thermal needs allowing for hydraulic power might be 33 million tons. The recent discovery of natural gas (1,000 B.Th.U./cu ft) in France was expected to result in a yield in 1965 equal to five million tons of coal.

In Germany hydro power accounted for the equivalent of 5·75 million tons of coal in 1955 and was not expected to increase much. Coal consumption in public supply power stations in 1955 amounted to 18·6 tons of black or brown coal converted to the same heat value and might reach 31 million tons in 1965 and 48 million in 1975. Industrial generation, however, formed over 37 per cent of the total (compared with 8 per cent in the United Kingdom) and much of it was sold in bulk to distributing companies.

Figures for consumption of energy for various purposes were given in the address, which led to the conclusion that the overall fuel requirements in 1965 and 1975 expressed in millions of tons of coal equivalent were likely to be: Great Britain 368 and 460; France 155 and 220; Germany 236 and 318. The prospect was that in less that ten years hence Britain would be short of requirements by 40 million tons of coal or its equivalent. Enough electricity might be produced from nuclear sources to make up 10 million tons of this deficit, necessitating the importation of 30 million tons a year. The other countries under consideration would be in somewhat similar case and the three altogether would need to import 175 to 195 million tons of coal equivalent in 1965, 100 million of which would be in the form of petroleum for motor cars and aeroplanes. Commercial use of nuclear fusion before 1975 could be ignored. A substantial difference in probable fuel requirements of the future could arise from quite small improvements in utilisation efficiency. An additional 1 per cent annual increase overall should be possible in existing industrial plants by known methods.

Nuclear Fusion Investigations

IN a talk to M.P.s who belong to the Parliamentary and Scientific Committee, Sir John Cockcroft, the director of the Atomic Energy Research Establishment at Harwell, described a number of methods by which the scientists measured the temperature in "Zeta" to prove that they had reached 5 million deg C. The next step was to feed ten times more energy into "Zeta" from a bigger condenser bank. With modifications to the torus and to the method of stabilising the axial field, temperatures should rise well beyond the centre temperature of the sun, and the neutron yield should increase at least a millionfold.

Next would come the task of designing and building "Zeta II," which would be aimed at reaching the break-even point, at which the energy output equalled or surpassed the electrical energy put in. It would also be the point at which temperatures of 100 million deg C would be reached. "We shall design 'Zeta II' so that we can, at the same time, experiment with methods of transforming energy directly into electricity," he said. "It is already possible in principle to see how a good part of the energy might be directly converted."

Sir John Cockcroft went on to forecast the timetable for the project. "Even if the 'Zeta II' stage of the project is successful, we shall still be some distance from a commercial power station of this type four or five years from now," he declared. The first stage would be to build a fusion power station prototype. If it were an enlarged type of "Zeta" apparatus, the ring of current would be of the order of several million amperes. He estimated, however, that the fusion power station, as a commercial proposition, was still at least 20 years away, and perhaps much longer if the scientists met many "road blocks" on the way. They would, however, press on with all speed "until we are stopped."

He was often asked whether fusion power would bring the millennium of cheap power for the world. "The only answer we can give with confidence," he told the M.P.s, "is that the fuel costs will be negligible, because one kilogram of deuterium, which costs perhaps £100, would produce as much energy as 10,000 tons of coal, costing, say, £40,000." But he impressed on his audience that the project was so far off that it was impossible to make any reliable forecast of either capital or operating costs.

Both the Americans and the Russians were engaged in similar experimental work, he said, and it was expected that scientists from both countries would describe their achievements at the conference on the peaceful uses of nuclear energy to be held in Geneva in September.

MANUFACTURING PROGRESS IN 1957

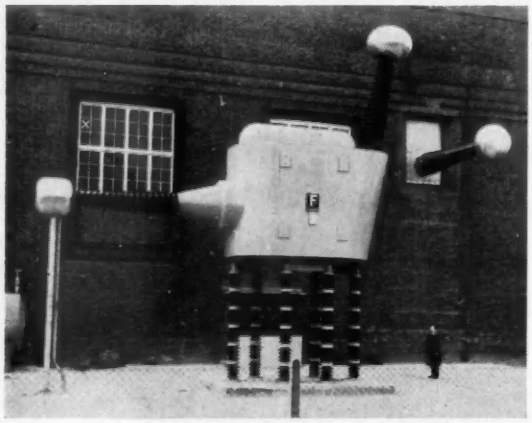
Ferranti, Ltd.

THE production of large power transformers by Ferranti, Ltd., in 1957 was maintained at the high level of recent years. A total of nearly 2¾ million kVA was completed including, for supply authorities in the home market, three 120 MVA, 275 kV; and two 75 MVA, four 60 MVA, two 45 MVA and one 30 MVA, 132 kV units.

Transformers shipped abroad included two 189 MVA three-phase banks of generator transformers for the U.S. Army Corps of Engineers, Dalles Dam Project, Columbia River, one for 230 kV operation and one for 115 kV operation; five 60 MVA, 132 kV, three-phase transformers for the Electricity Commission of New South Wales; one 80 MVA, 154 kV, three-phase bank of transformers and spare unit for the Tennessee Valley Authority, U.S.A.; and several transformers of up to 36 MVA rating for South Africa and India.

Large American Contract

The outstanding order received during the year covered the supply of thirteen transformers for the Power Authority of the State of New York's Niagara project, Lewiston power plant. This contract, comprising seven 180 MVA, 240 kV, and six 180 MVA, 120 kV, three-phase transformers, is believed to be the largest overseas transformer order ever to be placed in the United Kingdom,



1,000,000 V, 700 kVA testing transformer installed at the N.P.L.

surpassing the contract for the transmission transformers for the Kariba hydro-electric scheme, Southern Rhodesia, placed with Ferranti during 1956.

Other overseas contracts included two 177 MVA, 134 kV, three-phase transformers for the Consolidated Edison Company of New York, Inc., for the Indian Point generating station; two 100 MVA, 154 kV, three-phase banks of transformers and spare units for the Tennessee Valley Authority, Lawrenceburg and Dyersburg; and two 100 MVA, 115 kV, three-phase banks of transformers for the U.S. Army Corps of Engineers, Garrison Dam project, North Dakota.

Orders for the home market included 225 MVA, 295 kV; 145 MVA, 304 kV; and 120 MVA, 275 kV transformers for the supergrid, several large units for 132 kV operation and a number of system transformers.

Considerable development work has been taking place during the year on on-load tap-changing equipment, and a new high-speed transition resistor gear for 132 kV has been produced and is now being supplied in transformers for the Central Electricity Generating Board. A similar type of gear is at present under construction for 33 kV transformers, and units manufactured during 1958 by Ferranti and by other manufacturers will incorporate this new type of on-load tap-changing equipment.

The demand for distribution and industrial type transformers has again continued at a high level. Many installations of Class "C" insulated transformers of ratings up to 800 kVA have been completed during the year, and what is believed will be a solution to the ever-increasing problem of finding suitable sites for substations in heavily built-up industrial areas is the satisfactory installation of a buried type Class "C" insulated transformer of 500 kVA, 11 kV rating in conjunction with the South of Scotland Electricity Board. Advantage has been taken of the high operating temperatures and non-hygroscopic properties of Class "C" insulation to design and manufacture a transformer which can be buried in the street (or any other piece of available ground) with only a small ventilation pillar showing above ground to circulate the cooling air, which is by natural convection only.

A vigorous programme of research and development is taking place, particularly into the problems of noise, the use of silicone materials, cold-rolled steels, and other general development work on distribution transformers.

The company has maintained its position in the manufacture of high-voltage and impulse testing plants. The 1,000,000 V, 700 kVA testing transformer supplied to the National Physical Laboratory, and believed to be the largest outdoor testing transformer in the United Kingdom, was successfully commissioned during the year. Several other large equipments have been completed, including a 400 kV, 1,600 kVA testing plant for Pirelli-

An 80 MVA, 154 kV three-phase bank of transformers for the Tennessee Valley Authority, U.S.A.

General Cable Works, Ltd., and a third 300 kV, 600 kVA high-voltage reactor unit for Standard Telefon og Kabelfabrik, Oslo, Norway.

Manufacture of moving coil voltage regulators for transmission and distribution systems at home and abroad has continued at a high level. In addition the development and manufacture of designs to meet special requirements form a substantial part of the year's work, including the manufacture of "Pyroclor" filled moving coil voltage regulators to reduce fire hazard in dangerous locations. Considerable development work has also taken place on power factor control in interconnected systems which has resulted in an order being received for two 10,000 kVA, 11 kV moving coil regulators for this purpose.

Moving coil voltage regulators are also under construction with servo-control equipment for use in connection with research into kinetic heat problems associated with supersonic speeds in the aircraft and guided missile fields.

LLOYD'S REGISTER OF SHIPPING

THE Land Division of Lloyd's Register of Shipping is a rapidly expanding branch of the Society and a considerable portion of the 1957 report of the Society is devoted to this section of its activities. The Society is responsible for the full inspection of the primary circuits—reactors, steam-raising units, main gas ducting, etc., at the Calder Hall and Dounreay nuclear power stations, the Berkeley and Bradwell stations of the C.E.G.B., the Hunterston station being built for the South of Scotland Electricity Board, and at Chapel Cross; in addition, inspection work at Berkeley is extended to cover mechanical and electrical equipment. The Society's advisory service to the industrial groups is engaged on design work for future stations, and some work is in hand on advanced projects.

Reviewing the present trend of development in the field of nuclear power, the report states that the power output per unit from the stations under construction is intended to be considerably greater than at Calder. To obtain this, primary circuit pressures and temperatures are to be increased, resulting in increased steam generation. Limiting factors are the size and thickness of the reactor vessel which can be fabricated on site. The time is coming when the relatively simple approach of increasing power by increasing the size and shell thickness of a normal carbon steel reactor vessel will no longer be practicable. Various choices are open. One which has possibilities, as far as land-based plant is concerned, is the method now being tried in France of using a pre-stressed concrete shell, steel lined. Another is to use higher temperatures and pressures with the same or even a smaller reactor vessel. This needs for its implementation an improved type of fuel element and either creep-resisting higher tensile steel for the shell so as to reduce thickness, or higher tensile steel with internal shielding to keep shell temperatures below the level at which creep becomes a problem. Practical difficulties of design and site fabrication are apparent and formidable.

Nuclear Propulsion

Dealing with nuclear propulsion, the report states that at the invitation of the United Kingdom Atomic Energy Authority, the Society assisted in a feasibility study which shows that with the optimum size of gas-cooled graphite moderator using slightly enriched fuel, a propelling plant with an output of 50,000 s.h.p. could be built. Realising that a considerably smaller unit would have wider possibilities in application, a concurrent study by the Authority was carried out on an alternative design of a 25,000 s.h.p. unit, but the resulting specific power costs were significantly higher. However, the differential between the specific power costs of comparable nuclear and conventional plants is low enough to encourage further investigation in these power ranges to be continued, but for powers lower than 25,000 s.h.p. there does not at present appear to be any possibility of economic propulsion with any type of reactor so far designed.

While experience with power reactors to date has shown that they can be reliable in operation, the combination of capital costs and fuel costs is not at present attractive to shipowners. The problem hinges on a compromise between the use of costly enriched fuel and the saving to be made from the consequential reduction in size of the reactor. Help will be derived from future improved types of fuel element which will not only make possible more compact plants, but will provide longer operating life for the fuel charge of the reactor. The conclusion in the report is that nuclear merchant ships of conventional size are unlikely to be competitive for several years.

The report also deals with developments in straight gas turbines for main ship propulsion and for auxiliary machinery. At the end of the report there are a number of tables on world shipping. These include one analysing the propulsion of world tonnage from 1932 to 1957. This shows that at the end of last year steamships with a total gross tonnage of 5·3 million had turbo-electric propulsion, and motor ships totalling 310,216 tons gross had diesel-electric propulsion.

Mines and Quarries

THE recently issued report of the Chief Inspector of Mines and Quarries, Mr. H. C. W. Roberts, for the years 1954, 1955 and 1956 (H.M. Stationery Office, 3s 6d) includes reports of electrical accidents in metalliferous mines and quarries.

With regard to quarries, the report states that a considerable amount of work is still required to raise some quarries to the standards laid down in the Quarries General Regulations (Electricity), 1938. Defects in electrical installations which were found in many quarries included such items as insufficient clearance between overhead lines and ground, medium voltages applied to portable apparatus, flexible cables without flexible metallic screens, lack of suitable earth leakage protection, and lack of isolating facilities. In 1955 there were two instances of persons receiving shocks and burns from excavators fouling overhead lines and in 1956 a driver of a large rear dump truck was electrocuted when the tipping rams fouled an overhead line.

In the section of the report dealing with metalliferous mines, it is noted that a non-fatal accident occurred in 1954 in an underground switch-house when an electrician received shock and burns when replacing the covers of the busbar compartments of an outgoing feeder switch. The supply was 3·3 kV with the neutral point earthed. The accident was due to the electrician's failure to switch off the busbar isolator from the mine ring main system.

Restrictive Trade Practices Court

FRACTIONAL HORSE POWER MOTORS AGREEMENT

WHEN the Restrictive Trade Practices Court sat for the first time last week it heard an application by the Registrar of Restrictive Trading Agreements for a declaration that the Fractional Horse Power Electric Motors Agreement was contrary to the public interest. The Registrar also asked for orders restraining the respondents from giving effect to, or enforcing, the restrictions in the agreement, and from making any similar agreement.

According to Mr. J. Cumming-Bruce, who appeared for the Registrar, the agreement had come into force in February, 1957, and had all the appearances of what was commonly called a "price ring." The main restriction was not to offer or supply f.h.p. motors or accessories or extras at prices lower than the prices determined from time to time by the parties. These were the British Thomson-Houston Co., Crompton Parkinson, Ltd., the English Electric Co., the General Electric Co., Lancashire Dynamo & Crypto, and the Metropolitan-Vickers Electrical Co. Although the agreement had been registered, it had been subsequently decided not to defend it, and it had been terminated on 25th February, 1958.

For the Fractional Horse Power Motor Manufacturers' Association, Mr. Bryan MacKenna said they would agree to the making of the order as sought, but he asked the Court not to restrain the respondents from entering into any similar agreements. The Association, he said, were not unreasonable in asking that they should not be put in a worse position than if the agreement had not been registered at all.

In giving the decision of the Court, Mr. Justice Devlin said that although they could not agree to the limitation sought by Mr. MacKenna they would be prepared to adjourn the matter in order to give the respondents time to decide whether they wished to submit to the order or to fight the case. In accepting this offer, Mr. MacKenna gave an undertaking that during the period of the adjournment no similar agreement would be brought into force.

It may be helpful to readers if we point out that the Registrar is required by the Act to bring all agreements on the Register before the Court, irrespective of whether, as in this case, the agreement has subsequently been terminated. If the Registrar had obtained the orders he was asking for, the respondents would have been precluded from taking advantage of future decisions by the Court in favour of similar agreements of this type. By securing an adjournment the Association will be able to await the outcome of these and other cases before they decide whether they would do better to fight the present case or to conclude a new agreement in the light of the Court's decisions. If this new agreement were registrable it would, of course, eventually have to go before the Court for a decision whether or not it was in the public interest.

Earlier in the proceedings, Mr. Cumming-Bruce announced that there were now 46 cases in preparation for consideration by the Court—39 in England and the rest in Scotland. The Court decided to sit as one division for the Michaelmas Term which begins on 6th October, and it was thought that there would be sufficient work from next year's Hilary Term to keep the Court sitting continuously in two divisions.

ELECTRICITY GENERATION IN LONDON

THE discussion of the paper on electricity generation in the London Area presented by Mr. H. V. Pugh at the Institution of Electrical Engineers last week (see *Electrical Review*, 25th April, page 789) was opened by Sir John Hacking (Merz & McLellan). Referring to the early days of the electricity supply industry, he said that the first installations had been supplied from overhead cables largely supported from houses. There was then a wide difference of opinion whether the supply should be d.c. or a.c., with a general preference for d.c., largely because of the use of batteries to improve load factor. When a.c. supplies were given, they were single-phase. Sebastian de Ferranti, a protagonist of the a.c. system, held strongly that generation should be on as large a scale as possible and that the generating plant need not be near the load. He selected a site at Deptford for development, intending to build there a station of 120,000 h.p., with units of 10,000 h.p. to supply a cable system of 10,000 V single-phase, which would run along the railways. The big plan was abandoned and some of the sets from the Grosvenor Gardens station, where there had been a fire, were reconstructed at Deptford. Ferranti's ideas had since been followed by supply engineers all over the world. Sir John drew attention to the duty imposed by the 1926 Act on the Central Electricity Board to standardise frequency throughout the country. As the load had been doubled every ten years, they had good reason to be glad of this decision.

Mr. W. N. Kilner (Metropolitan-Vickers Electrical Co.) said the author had claimed that the reduction in fuel consumption in the London Division since 1948 was due to improved efficiency of operation. Was it not partly due to the installation of new and more efficient plant? In 1956 over half of the total kWh sent out by the London Division was produced by plant installed after 1945, and thirteen sets not more than four years old were responsible for nearly one-third of the total output.

Mr. L. H. Welch (London Electricity Board) mentioned the very close liaison between the engineers of the London Division and of the London Board. Both were represented on joint machinery and their arrangements for education and training were similar. The Division deserved the fullest praise for the reliability of its supply, because there had been no major shut-downs since vesting day. Voltage maintenance was reasonable, but prices per kWh were far too high. They had increased by about 50 per cent during the past ten years, but the Board had passed on only 30 per cent to consumers. The

Board could not lower prices at off-peak; this must be a combined operation by the industry as a whole.

Mr. E. B. Powell (Central Electricity Generating Board) said that a problem in London was the high concentration of load in a very compact network, which put up short-circuit values to such an extent that the only way of getting them down was to install reactances in one form or another. The high charging capacity pointed out in the paper and the figure given in the table for networks of 22 kV and upwards included everything in the London Area and a large section of the Southern Area network. It was now well over 650 MVAr, would be 700 MVAr by 1960 and soon afterwards would be nearly 800 MVAr. This might well decide the voltage level in the South of England due to supply from the supergrid and shutting down generating plant in London.

Mr. W. N. C. Clinch asked why they were changing over to oil firing for some boilers at a time when a committee was sitting to inquire how the country could use the surplus of small coal which existed. He thought the author could have paid more tribute to the honourable intentions of those who worked in the electricity supply industry in the past and who had done their best to maintain electricity supply so that it was not affected by Acts of Parliament passed by people who never had to put them into effect.

Mr. Pugh, in reply, agreed with Mr. Kilner that a substantial part of the kWh had been generated by new plant, but added that the quality of fuel had deteriorated with the change-over from stoker-fired to pulverised-fuel-fired boilers. With the change, however, the higher pressures and the larger units had made it possible to reduce fuel consumption. He also agreed that liaison with the London Electricity Board was very close.

THE "VARISLIP" MOTOR

New Compact Variable-Speed Machine

THE use of eddy-current couplings enables a variable-speed output from a constant-speed power source to be obtained by control of the electrical excitation current of the eddy-current coupling. When an electric motor is used as the constant-speed power source in conjunction with a separately designed eddy-current coupling, the combined unit occupies a large amount of space for the final power output obtained. The "Varislip" unit made by British Thomson-Houston Co., Ltd., has been designed as a combined a.c. motor and eddy-current coupling to occupy the minimum amount of space by incorporating both units within one casing. Fig. 1 shows that a compact unit has been made possible by placing the eddy-current couplings within the stator end-windings in a space which does not normally contain active materials. Since the maximum diameter of coupling which can be fitted in this space is strictly limited, it is necessary to use two couplings, each of which handles half the motor torque.

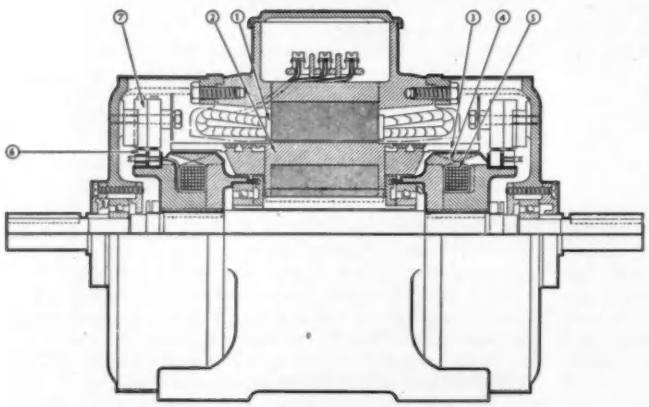
The outer members of the eddy-current couplings are secured at each end of the squirrel-cage rotor, and this assembly is mounted upon the final output shaft with two ball-bearings, so that the rotor is free to rotate at full motor speed when the couplings are unexcited. Mounted on the final output shaft at either end of the squirrel-cage rotor are the two eddy-current field systems. Each of these field units is complete with an excitation coil fed through slip-rings from brushes mounted in each endshield.

When the motor stator is connected to a three-phase a.c. supply with no excitation current in the coupling windings, the motor rotor and coupling outer members run up to the full speed of 1,500 r.p.m., but no torque is transmitted to the output shaft. By applying d.c. excitation current to the coupling field coils, torque is generated at the couplings and so transmitted to the output shaft. The output speed against a given torque will vary with excitation current flowing in the coupling windings. Speed variation is obtained by control of the excitation current.

It is not possible to assign a definite horse-power rating to a "Varislip" motor which is dependent upon peak torque output required, permissible slip at the required peak torque and temperature rise of the motor or coupling windings during the duty cycle required. In order to keep the temperature rise of the No. 1 size within a safe maximum value, the maximum loss with an operating time of 10 minutes must not exceed 2,200 W and the maximum loss for a continuous rating must not exceed 500 W. By using these figures in conjunction with speed-torque curves, it is possible to check if this size of "Varislip" motor is suitable for the duty and duty-cycle of a particular application. For example, the continuous rating at 1,000 r.p.m. is limited by heating from 500 W loss to a torque output at 4·5 lb ft, which is equivalent to 0·86 h.p. at 1,000 r.p.m. It should be emphasised that an eddy-current coupling is not a "torque convertor." The torque demanded of the motor is equal to the torque exerted by the couplings on the output shaft, and the product of this torque and the slip speed is a measure of the eddy-current losses in the outer members of the eddy-current couplings. A second size unit in course of development will have a rating approximately two to three times the values given for the No. 1 unit. The motor was developed by the B.T.H. Co. in conjunction with the Vaughan Crane Co., Ltd., for use in a variable-speed hoist block. More recently, units have been applied to the hoist and travel motions of overhead travelling cranes.

Fig. 1.—Half-sectional view of the "Varislip" motor

1. Induction motor stator core and windings. 2. Induction motor cast aluminium rotor cage. 3. Eddy-current coupling, outer member. 4. Eddy-current coupling, field member. 5. Eddy-current coupling, excitation coil. 6. Sliprings. 7. Brush boxes



GENERATION AND DEVELOPMENT

Kent Concern over Supergrid

Kent County Council announced last week that it was to call a meeting with other local authorities to discuss the Central Electricity Generating Board's proposal to erect a transmission line from Dungeness to Northfleet, via Canterbury. The Council said that although it accepted the industrial importance of the link it wished to safeguard the landscape of Kent. A report from an independent consultant, Mr. G. A. Jellicoe, and the county planning officer, Mr. J. Adams, regretted that the Board had not made an intensive research into methods of reducing the cost of placing high voltage lines underground, and said the new pylons would straddle the county from the English Channel to the River Thames. It made strong objection to the proposed line south of the Medway towns, across the north downs and the Luddesdown Valley, and said that the pylons would cross eight miles of some of the most attractive, unspoilt scenery in Kent.

Payments in Lieu of Rates

The General Purposes Committee of the Association of Municipal Corporations reports that notification has been received from the Ministry of Housing and Local Government of the amounts estimated to be payable by the British Transport Commission and the Electricity Council in lieu of rates for the years 1957-58 and 1958-59. For the Electricity Council the figures are: 1957-58, £19·56 million; 1958-59, £22·48 million. The Central Electricity Authority's 1956-57 report gave the amount for that year as £16·73 million. The finally calculated figure for 1955-56 is £16·18 million.

The estimated amounts payable by the British Transport Commission are: 1957-58, £2·26 million; 1958-59, £2·60 million.

Caithness Peat Experiment

Speaking at Ullapool last week, Mr. Thomas Johnston, chairman of the North of Scotland Hydro-Electric Board, referred to the experiment being carried out at Altnabreac, Caithness, in the use of peat deposits for the generation of electricity. In the U.S.S.R., he said, peat had been burned for 30 years for that purpose. In 1956 there had been 25 million tons burned in the power stations. By 1960 Russia expected to be burning 33 million tons. The Caithness experimental closed cycle peat-fired turbine, Mr. Johnston continued, was believed to be the first of its kind anywhere, but it was on a small scale —with an output of 16 to 20 million kWh per annum—and it was unlikely to produce electricity at less than 2d/kWh. A great deal would depend on the value of the agricultural land which might be uncovered when the peat was burned.

Earlier, Mr. Johnston had officially opened a quarry for the production of high-grade magnesium limestone, established by William Lind & Co., Ltd., at a cost of about £100,000. The new industry, made economically possible because cheap electric power for the elaborate processing plant is available from the North of Scotland Hydro-Electric Board's Loch Dubh project, will benefit Scottish farmers and go a long way to reviving thousands of acres of over-grazed hill land. The electrical installation at the plant was by James Scott & Co. (Electrical Engineers), Ltd., Perth.

Unpriced Coal Tenders

Mr. R. P. Watson, the city electrical engineer, has informed the Belfast Corporation Electricity Committee that, because of variations in charges for the supply and delivery of coal, it was impossible for importers tendering to the Corporation to quote actual prices. Mr. Watson said that the prices would be based on the National Coal Board's invoiced rates to shippers, and the invoices would be made available to the Corporation for inspection if required. The freight charges would be based on the schedule of the Chamber of Shipping of the United Kingdom.

Tenders from two firms for 507,000 tons were approved, and the matter was to go before the City Council yesterday (Thursday).

Progress in S.E.B. Area

Each consumer in the Southern Electricity Board's Area now uses on an average 4,270 kWh a year, compared with 2,350 kWh in 1948, an increase of approximately 80 per cent. In the same period the number of consumers has risen from 875,000 to 1,303,000, the latter figure including 21,000 farms (against 8,500 in 1948). These facts are given in a review of the progress made by the Board since nationalisation. The proportion of the total number of farms in the Area supplied is now 82 per cent.

While the cost of living, based on the index of retail prices, has risen by some 55 per cent, the average cost of electricity to consumers is only 14 per cent higher than it was ten years ago. The Board, which has made a profit each year, spent £3,850,000 on capital works in 1948 as compared with nearly £8 million for the tenth year.

Supply Agreement

Jarrow-on-Tyne Finance Committee and the North Eastern Electricity Board have reached an agreement regarding the supply of electricity to old houses in the Franklin Street and Nansen Street areas. Under the Town Council's development plan the houses are scheduled for demolition in about ten years, and the Electricity Board was not prepared, without a guarantee regarding revenue, to supply electricity to the houses unless their life was extended. The Committee now proposes that the houses should not be pulled down for periods up to 20 years, and the Board has agreed to carry out the work on this basis.

Policy on Electrical Work

Middlesbrough Town Council has decided to adhere to its present system of carrying out electrical work. Up to about 1952 the North Eastern Electricity Board helped the Corporation by preparing details of major works, but in recent years the Council has employed outside consultants. The borough engineer (Mr. J. A. Kenyon) stated that if the Council proposed setting up its own electrical department it would be necessary to appoint a fully-qualified electrical engineer and electrical inspector. The amount of electrical work which could be carried out by direct labour would depend upon the recruitment of electricians, and he pointed out that other concerns were already experiencing difficulties in obtaining electricians. The Council has therefore decided to continue its present system whereby consultants and outside contractors are employed.

Electric Water Heating

At Bilston the Housing Committee recommends the provision of electric hot water systems in over 2,000 pre-war Council houses at a cost of over £80,000.

OVERSEAS

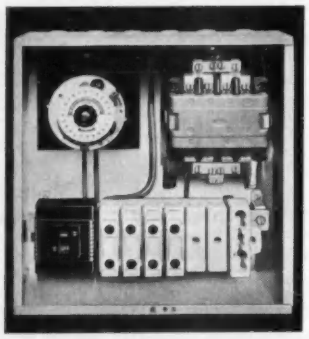
Sydney Trading Surplus

Sydney County Council Rates Committee, meeting for the second time in two weeks to discuss proposed reductions in electricity charges, again failed to reach a decision on whether industrial or domestic consumers should benefit. It called for a report from the general manager, Mr. C. E. Ranger. The Council made a trading surplus of £619,678 last year.

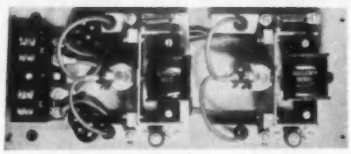
Power from St. Lawrence in August

The Premier of Ontario, Mr. Leslie Frost, stated in the Ontario Legislature recently that the St. Lawrence project was now well advanced and the first power was expected to be delivered next August. By the end of the year six of the 16 units should be in service. When completed, this project would generate 1,100,000 h.p. for Ontario.

NEW ELECTRICAL EQUIPMENT

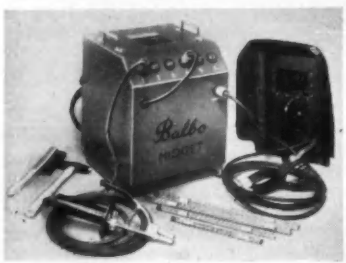


M.E.M. type 2FHC/R off-peak control unit



Baggs double single-pole contactor

Hotpoint "Plus 6 Countess" washing machine



Balbo "Midget" arc welder

Off-peak Control

A unit designed for the control of night load only, for those installations where the day load is already controlled and protected by separate equipment, is announced by the MIDLAND ELECTRIC MANUFACTURING CO., LTD., Reddings Lane, Tyseley, Birmingham, 11.

The unit, type 2FHC/R, consists of a 12in by 12in by 5in mild sheet steel case containing a "MEM-AC" 60 A 250 V double-pole main switch, and a time switch, which operates the 60 A single-pole, 250 V, 50 c/s "Autoline" contactor. The underfloor heating or storage heaters and water heater circuits are protected by six 15 A "Memcert" s.p. and n. fuses.

Contactors for Street Lighting Control

A double single-pole contactor for street lighting control has recently been developed by JOHN BAGGS & CO., Relay Works, Station Road, Uppermill, near Oldham, Lancs. The contactor is designed so that the armature moves at right-angles to the electromagnet. This gives a long pull which falls off at the end of the travel, so operating the mercury switches without shock and, since the armature does not strike the electromagnet, there is no noise.

Other relays available include types with time delays, hold-on contacts, change-over contacts, etc.

Washing Machine

The latest addition to the range of washing machines manufactured by the HOTPOINT ELECTRIC APPLIANCE CO., LTD., Crown House, Aldwych, London, W.C.2, is the "Plus 6 Countess," a neatly styled cabinet type machine fitted with a 2 kW heater, pump and an 11in wringer. The wringer is removable, thus enabling the machine, which stands only 33½in high, to be stowed conveniently under the draining board. Its flat top working surface measures 19in deep by 17in wide. The bowl is square in shape and finished in an attractive shade of blue vitreous enamel. It has a water capacity of 8½ gal and accommodation for 6 lb dry weight of clothes at one time. The washing action is by means of a one-piece phenolic moulded gyrator.

The controls, clearly marked "Heat," "Motor," "Wash" and "Pump," are on a conveniently placed panel on the front of the cabinet. To prevent damage should the heater be switched on when the tub is empty, an automatic safety device is fitted. All edges of the machine are gently rounded and it is finished in white or cream stoved enamel with red controls. For ease of movement castors are fitted. Cleats are provided in the recess of the surface cover for stowage of the 9ft of three-core rubber sheathed cable and there is also a bushed hole to take the three-pin plug without projecting from the machine. The price is £56 16s 7d plus £12 9s 5d purchase tax in the United Kingdom. An unheated model is also available price £49 18s 10d plus £10 19s 2d tax.

Welding Generator

A welding generator suitable for direct or belt drive is being produced by B.K.B. ELECTRIC MOTORS, LTD., St. George's Works, 132, Icknield Street, Birmingham, 18. Particular attention has been given to the design of the generously proportioned commutator and rigid brushgear. The machine is suitable for operation in tropical climates and humid atmospheres and the standard enclosure is drip-proof.

The generator is cumulatively compound-wound and has a special slotted pole field system giving the necessary drooping voltage characteristic with a minimum of external resistance; adequate striking voltage on every current range is combined with exceptional arc stability. The control panel is contained in a drip-proof, ventilated, sheet steel case rigidly secured to the generator frame. There is a separate variable rheostat unit for adjusting the open-circuit and arc voltage for various applications. This latter feature ensures "overlap" of the welding current within the selected range; hence the precise arc characteristic required for a particular electrode or a type of work can be obtained with a minimum of adjustment.

Arc Welding Plant

BALBO WELDING PROCESSES, LTD., 29a, Stanley Road, Teddington, Middlesex, are producing a 150 A "Midget" arc welding machine. This provides an easily struck, smooth running arc with full penetration, producing sound, strong welds in downhand, vertical or overhead positions for any type of joint. It is particularly suitable for constructional work on site and it can be used for industrial repetition work on metals ranging from 20 gauge sheet to 1in plate. The transformer is double wound and air cooled; the primary current at 190/250 V is 5/25 A and at

380/500 V it is 4/13 A. The continuous hand welding current is 120 A and the weight is 98 lb.

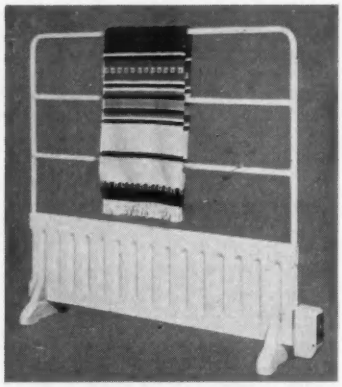
A "Duplex" machine comprising two units in one case is also available.

Hand and Clothing Monitor

A hand and clothing monitor, type 1, has been developed by E.M.I. ELECTRONICS, LTD., Hayes, Middlesex. Four large-area scintillation counters with special dual scintillators are used to simultaneously detect both alpha and beta contamination on the hands. Separate meter indications are provided and final meter readings remain after the hands have been removed. These readings are cancelled when the next person begins testing. Audible and visible danger level warnings are given should the user be contaminated in excess of the maximum permissible level. The two probes attached to the sides of the main cabinet which provide separate indications of both alpha and beta-gamma levels are used to measure radiation from clothing and footwear. These probes may be used at the same time as the hand counters.

Towel Rail

The latest addition to the range of oil-filled radiators manufactured by HURSEAL, LTD., 229, Regent Street, London, W.1, is the "Towelrad" heated towel rail. The lower section consists of one of the company's latest 500 W low panel radiators to which



Hurseal "Towelrad" heated towel rail

have been added three tubular towel rails, providing 9ft of airing space. Detachable feet are fitted to the radiator, allowing the user to change it from floor use to wall mounting simply by unclamping the feet and fitting wall brackets. Flex is not supplied because the appliance, when installed in a bathroom, should be wired in accordance with the I.E.E. Regulations.

The "Towelrad" is 3ft high by 3ft wide and is available finished in white stoved enamel. Standard cream or bronze or other colours can be supplied on request. The price, complete with thermostatic control and feet or brackets, is £11 9s 6d plus £2 10s 4d purchase tax in the United Kingdom.

Argonarc Welding

A composite power unit which is designed for use with the Argonarc welding process is now being marketed by BRITISH OXYGEN GASES, LTD. (Industrial Division), Spencer House, St. James's, London, S.W.1. Known as the CPU 350, it is suitable for a.c. welding of aluminium and its alloys up to ¾in thick in a single pass, and the welding of stainless steel up to ¼in thick. A remote control foot switch, coupled with automatic arc starting and control of both argon and water, enables the welding speed to be increased.

The unit incorporates surge injection, which is the introduction into the arc of a d.c. pulse, timed to coincide with the beginning of the oxide scavenging positive half-cycle only. It is of sufficient magnitude to cause the arc to ignite immediately and thus provides a full positive half-cycle. Surge injection allows a substantial reduction of open circuit voltage, resulting in a lower transformer rating, together with a reduction in the amount of current taken from the mains. The unit is suitable for 360/500 V 50 c/s single-phase operation, with a striking voltage of 50 V. The rating is 10·75 kVA continuous or 17·5 kVA at 0·5 duty cycle. Welding current is 25 to 350 A, and 215 A continuous.

Berry's New Electric Fires

FOUR new designs of electric fires have been introduced by Berry's Electric, Ltd., Touchbutton House, Newman Street, London, W.1, for the 1958-59 season. Two of these, the "Auraberry" and the "Charmberry," are coal effect models, the "Wellberry" has a log or coal effect and the "Studio" is a radiant type.

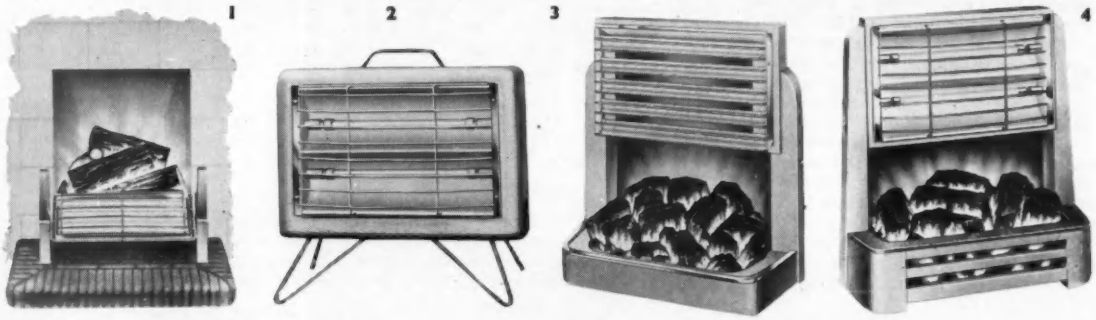
The "Auraberry," a 2 kW model, is provided with three-heat control (800, 1,200, 2,000 W) by two switches. It is finished in warm silver with polished rustless hob cap and radiant heat reflectors. It measures 22in square by 9½in deep and the weight is 21½ lb. The price is £13 18s plus £3 1s purchase tax in the United Kingdom. The other coal effect model, the "Charmberry," has a similar finish to the "Auraberry" and is available in 2 and 3 kW sizes. It is 21½in high by 20¼in wide by 8in deep and weighs 19 lb. The prices are £10 10s plus £2 6s 1d tax (2 kW) and £11 10s plus £2 10s 5d tax (3 kW).

The "Wellberry," designed for fitting into a 16in grate, is provided with a fuel effect (either log or coal) measuring 16in wide (front) and 9in (back) by 9in deep by 12in high. The heater section is 19½in wide by 5½in deep. The loading of the fire is 2 kW; it has a hammered finish; and the weight is 14½ lb. Its price is £9 14s 7d plus £2 2s 8d tax.

The "Studio" radiant reflector fire is designed on contemporary lines and is provided with tubular legs and a carrying handle. The loading is 2 kW and a half-heat switch is fitted. The overall measurements are 18in square by 19in deep and the weight is 8 lb. It has a silver rose hammered finish with cherry red legs and handle. The price is £4 10s plus 19s 9d tax.

All the foregoing models are fitted with safety guards and each is provided with 6ft of three-core flexible.

New fires from the Berry's 1958-59 season's range: — 1. "Wellberry." 2. "Studio." 3. "Auraberry." 4. "Charmberry"



Financial Section

STOCKS and SHARES

STOCK EXCHANGE markets entered May in a necessarily cautious frame of mind, but with a month of encouraging progress behind them. Gilt-edged stocks had made particularly good headway, which may be measured by the improvements of up to 2 points in the various British Electricity issues. To the gilt-edged influence is credited much of a useful improvement in industrial share prices over the month, although they had firm assistance also from the company dividend and profits statements published during April. In the market for electrical and associated shares, for instance, there was news of satisfactory or improved results from a variety of firms including Automatic Telephone, Lancashire Dynamo, Allen West, Babcock & Wilcox, Simon-Carves, Laurence Scott, Reyrolle, Ericsson, and T.C. & M.

Price Changes

Most of the larger price changes in the electrical equipment market have been connected recently with individual company news. In general, movements have been small and irregular. Hoover, at 39s, added 1s to the previous week's rise of half-a-crown, and Morphy-Richards were another 6d higher at 16s 9d; but otherwise there was little further progress in the advance of shares concerned closely with the reduction of purchase tax on domestic appliances. Pending more news about the discussions between Johnson & Phillips and W. T. Henley's Telegraph Works Co., prices of the shares tended to drift lower. Annual results of the latter company were expected to be known yesterday (Thursday). Lancashire Dynamo were well supported up to 37s 6d, and Allen West moved up further to 10s 6d, both under the influence of the 1957 results reported earlier.

Company News

Pye 5s "A" shares were little altered, at 12s, by the publication of details of the £2½ million issue of 6 per cent debenture stock, which is being offered to holders of the deferred and preference stocks at a price of 98. In their statement accompanying the offer, the directors estimate provisionally that group profits (before tax) for the year ended in March may show a fall of up to one-sixth on the previous figures, but would regard such an outcome as satisfactory in the light of conditions encountered during the period. Sturtevant 5s shares were quoted lower, at 16s 3d, on news of the decline in profits, although the dividend is kept at the same rate as before. Aerialite are raising their interim dividend from 19 to 20 per cent, and the 1s shares were firm at 6s 9d. Elliott-Automation were a few pence lower at 13s, although the dividend and profits reported were very much as forecast at the time of the merger.

Engineering Results

The final dividend of 6¾ per cent declared by Babcock & Wilcox is in

Price Changes in

Company or Board	Nom. Value	Middle price 28th Apr.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1958 Highest	1958 Lowest
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	75		3	3	4 0 0	75	72
Brit. Elec. 1974/77	100	72½	+½	3	3	4 3 3	72½	68½
Brit. Elec. 1976/79	100	76	+½	3½	3½	4 12 9	76	72
Brit. Elec. 1974/79	100	85½	+½	4½	4½	5 0 0	85½	82½
Overseas Electric Supply								
Calcutta Elec.	£1	16/-	+6d	6†	6·8†	8 10 6†	16/9	15/-
East African Power	£1	19/-		7	7½	7 18 0	19/3	17/6
Nigerian Elec.	£1	15/-		10	10	13 6 9	17/-	14/9
Perak Hydro-Elec.	£1	14/6		10	12½	17 4 9	15/6	14/6
Electrical Shares								
Aberdare Cables	5/-	11/3	−3d	17½	17½	7 15 6	11/6	9/9
Aerialite	1/-	6/9		48	51½	7 12 9	6/9	5/1
Allen, W. H.	£1	34/6		10	10	5 16 0	35/-	32/9
Anglo-Portuguese Tel.	£1	23/9	+6d	8	8	6 14 9	23/9	19/9
Aron Elec. Ord.	£1	53/9		15	15	5 11 6	54/6	53/-
Assoc. Elec. Ord.	£1	49/6	−1/3	15	15	6 1 3	51/3	46/6
Automatic Tel. & El.	£1	65/9	−6d	17	17	5 3 3	66/3	57/-
Babcock & Wilcox	£1	48/9	−6d	15	13‡	5 6 6	52/9	41/9
Bakelite	10/-	19/6	+9d	15	15	7 13 9	21/-	17/6
Baldwin, H. J.	2/-	2/9		20	20	14 10 9	3/9	2/9
Berry's Electric	5/-	7/6		—	10	6 13 3	7/6	5/9
British Aluminium	£1	40/-	−2/6	12	12	6 0 0	47/-	40/-
Brit. Elec. Traction: Def. Ord. "A"	5/-	24/-	+6d	22½	25	5 4 3	24/-	19/6
B.I. Callender's	£1	44/6	+9d	12½	12½	5 12 3	44/6	38/9
B.I. Callender's 6% Pref. ...	£1	20/-		6	6	6 0 0	20/3	19/6
British Tabulating	£1	45/9	+9d	9	10	4 7 6	45/9	38/6
British Thermostat	5/-	25/-	+1/3	25	25	5 0 0	25/-	19/9
British Vac. Cleaner ...	5/-	4/9		10	10	10 10 6	5/3	4/6
Brook Motors	10/-	36/3		25	25	6 18 0	36/3	33/3
Bulgin, A. F.	1/-	5/-		40	45	9 0 0	5/6	4/7
Bulpitts	5/-	7/6		—	12½‡	8 6 9	7/6	7/6
Burco Dean	5/-	9/-		20	22½	8 6 9*	9/6	7/9
Cable & Wireless: Ord.	5/-	10/-	+6d	10	10‡*	5 0 0	10/-	8/-
4% Loan	100	94½		4	4	4 4 9	94½	89
Chloride El. Storage "A" ...	£1	60/6	+1/9	17½	17½	5 15 9	62/-	55/6
Clarke Chapman	£1	120/-		27½	27½	4 11 9	7½	5½
Cole, E. K....	5/-	18/-		17½	17½	4 17 3	18/-	15/6
Cossor, A. C.	5/-	4/9	−9d	Nil	2½	2 12 9	5/6	4/4
Crabtree	10/-	26/3		20	20	7 12 6	26/3	24/4
Crompton Parkinson Ord. ...	5/-	9/9	−3d	16	16	5 9 6*	10/3	8/3
De La Rue	5/-	24/-	−6d	30	35	7 5 9	25/3	20/9
Decca "A"	4/-	26/-	−1/6	43½	43½	6 14 6	27/6	21/3
Desoutter	5/-	14/-		30	18½*	6 14 0	14/3	13/6
Dewhurst	2/-	7/-		16½	20	5 14 3	7/9	6/9
Dictograph Tel.	2/-	6/-	+3d	20	20*	6 13 3	6/-	4/7
Dubilier Condenser	1/-	3/6	−3d	30	30	5 14 3*	3/9	3/1
Duport	5/-	8/6		25	25	7 16 3*	9/4	8/-
E.M.I.	10/-	32/6	−2/-	15	15	4 12 3	34/6	27/6
Electrical Components	5/-	7/6	−6d	25	12½*	8 6 9	8/-	7/-
Elec. Construction	£1	21/3	−1/3	8½	8½	8 0 0	22/9	21/-
Elliott-Automation	5/-	13/-	−3d	—	10‡	3 17 0	13/3	11/6
Enfield Cable Ord.	£1	14/-		Nil	2½	3 11 6	14/-	10/9
English Electric	£1	56/3		14	14	4 19 6	56/3	44/-
English Electric 3½% Pref. ...	£1	12/3		3½	3½	6 2 6	12/3	11/9
Ericsson Tel.	5/-	21/-		22‡	22†*	2 17 3†	21/-	17/6
Ever Ready	5/-	16/-	+1/-	35	37½	5 17 3*	16/-	13/9
Falk Stadelmann	£1	38/9	+1/3	17½	17½	9 0 9	38/9	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

accordance with the forecast made last January at the time of the issue of 1,881,000 new ordinary shares, which participate in this distribution. With the interim dividend paid before the issue, the total payment for the year is regarded as equivalent to an annual rate of approximately 13 per cent on the present capital, and this is the rate which the company anticipated for 1958. From the preliminary statement, it appears to represent a decidedly conservative distribution of the group's net profit, which at £1·78 million has improved by more than £200,000 on the figure for 1957. The £1 shares were subsequently little changed at 48s 9d, giving a prospective yield of 5·3 per cent. The 5s shares of Simon-Carves have been marked up by about 4s, to 27s 9d, since the company's announcement of a moderate rise in earnings and of an increase in the dividend from a total of 20 to 25 per cent. This also is a very well covered distribution, and brings the yield on the shares to 4½ per cent.

Electrical Investments

Company or Board	Nom. Value	Middle price 28th Apr.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1958 Highest	1958 Lowest
Electrical Shares—continued								
G.E.C. Ord.	£1	32/9	−6d	14	12½	—	38/9	29/3
G.E.C. 6½% Pref.	£1	20/9		6½	6½	6 5 3	21/3	20/3
General Cables	5/-	11/9		30	24	10 4 3	11/9	11/-
Greenwood & Batley	£1	47/6		17½	17½	7 7 3	48/-	45/-
Hackbridge Holdings	5/-	10/3		30	30	9 15 0	10/3	7/6
Hackbridge & Hewittic	5/-	12/-		23	20	8 6 9	12/-	9/7
Head Wrightson	5/-	17/9		20	22½	—	19/-	16/9
Heatrae	2/-	4/3		15	15	7 1 3	4/6	4/-
Henley's	10/-	13/9	−9d	11½	11½	8 7 3	14/6	10/6
Holophane	5/-	13/9		30	37½	8 3 9*	13/9	12/6
Hoover	5/-	39/-	+1/-	50	50	6 8 3	39/-	31/-
I.C.I.	£1	44/6	+6d	10	12	5 7 9	45/-	35/6
Intl. Combustion	5/-	23/6	−1/-	22½	25	5 6 6	24/6	19/3
Johnson & Phillips	£1	20/-	−2/-	15	10	10 0 0	25/-	15/-
Lancashire Dynamo	£1	37/6	+2/6	11	11	5 17 3	37/6	28/6
Laurence, Scott	5/-	14/9	+1/-	15	15	5 1 9	14/9	12/6
Lister, R. A.	£1	24/9	+6d	10	10	8 1 6	26/3	23/-
London Elec. Wire	£1	43/9		12½	12½	5 14 3	43/9	39/6
Lucas, J.	£1	33/-	−3d	7½	7½	4 11 0	33/3	27/9
Marconi Marine	£1	32/-		10	10	6 5 0	32/-	29/-
Marryat & Scott	2/-	12/-		30	35	5 16 9	12/-	10/3
Mather & Platt	£1	54/3		15	15	5 10 6	54/3	43/9
Metal Industries	£1	30/-	+6d	Nil	9	6 0 0	30/-	22/9
Midland Elec. Mfg.	£1	46/3		12½	12½	5 8 0	48/3	44/-
Morphy-Richards	4/-	16/9	+6d	50	20*	4 15 6	16/9	14/6
Murex	£1	53/3	−6d	20	20	7 10 3	57/6	53/3
Newman Ind.	2/-	2/3	−3d	10	10	8 17 9	2/9	2/3
Oldham & Son	1/-	2/6		17½	17½	7 0 0	2/7	2/3
Parnall (Yate)	5/-	7/9	−6d	12	12	7 14 9	8/3	5/9
Parsons, C. A.	£1	45/-	−1/3	8½	7½*	3 6 9	53/6	43/-
Plessey	10/-	58/3	−9d	30	30	5 3 0	59/-	55/-
Pye "A" Deferred	5/-	12/-	−9d	12½	12½	5 4 3	13/9	10/-
Reyrolle	£1	80/-	−2/6	17½	17½	4 7 6	84/6	73/6
Rheostatic	4/-	6/9		12½	12½	7 8 3	8/-	6/6
Richardsons Westgarth	10/-	14/6	−6d	16⅔	16⅔	5 15 0*	15/-	13/-
Scottish Cables	4/-	13/9		27½	27½	7 17 6	13/9	12/3
Simon-Carves	5/-	27/9	+4/-	20	25	4 10 0	27/9	22/6
Smith (England), S.	4/-	7/9	−3d	17½	20	5 3 3*	8/6	7/-
Southern Areas	£1	13/9	+2/9	7½	7½	10 18 3	13/9	9/6
Strand Elec.	5/-	4/9		15	15	15 15 9	6/3	4/9
Sturtevant	5/-	16/3	−1/9	15†	15†	4 12 3†	18/-	16/3
Sun Elec.	£1	47/6		25	25	10 10 6	47/6	47/3
Switchgear & Cowans	5/-	10/9	−1/-	25	22½	10 4 9	11/9	8/9
Taylor Tunnicliff	5/-	13/9	+6d	15	17½	6 7 3	13/9	11/9
T.C.C.	10/-	36/3		25	25	6 18 0	38/6	36/3
T.C. & M.	£1	26/3	−9d	8½	8½‡	6 9 6	27/-	20/-
Telephone Mfg.	5/-	4/9	+3d	10	10	10 10 6	5/2	4/6
Telephone Rentals	5/-	10/6		12½	12½	5 19 0	10/6	9/9
Thompson (John)	5/-	26/-	−6d	25	25	4 16 3	27/-	23/-
Thorn Elec.	5/-	21/3	−3d	15	17½	4 2 3	21/6	19/9
Thornycroft	£1	25/3	+3d	12½	12½	9 18 0	27/9	21/-
Tube Investments	£1	52/6	−1/6	13¾	15	5 14 3	54/6	48/3
Vactric	5/-	14/6	−1/-	17½	25	8 12 6	15/6	14/3
Veritys	5/-	5/3	−9d	12½	12½	11 18 3	6/9	5/3
Walsall Conduits	4/-	12/-		20	20	6 13 3	12/-	11/-
Ward & Goldstone	5/-	26/-	+1/-	35	40	3 17 0*	26/-	23/6
Watford	2/-	7/-	+3d	25	25	7 2 9	7/-	5/-
Westinghouse	£1	38/9		18	10*	5 3 3	38/9	32/3
West, Allen	5/-	10/9	+6d	15	12½*	5 16 3	10/9	9/3
Wolf Electric	5/-	6/9	−3d	20	10*	7 8 3	9/-	6/9

T.C. & M. Prospects

In his statement circulated with the full annual report of the Telegraph Construction & Maintenance Co., Sir John Dean makes it clear that the increase from 1 to 2½ per cent in the cash bonus payment for 1957 arises from large tax credits related to previous years, and is "peculiar to the year under review." In the market, the yield on the shares is calculated consequently on the basis of the 7½ per cent dividend plus 1 per cent bonus. In the year under review, the group profit (before tax) improved by 26 per cent, and the chairman referred to the outcome as most satisfactory in the light of present conditions. He made a cautious assessment of the early prospect, with mention of a reduced but healthy order book.

Dividends Declared

Laurence, Scott & Electromotors 5s "A" shares were 1s higher, on balance, at about 14s 9d, after the company's announcement of a trading profit for 1957 of just over a million, which is slightly above the previous figure and the maintenance of the single annual dividend at 15 per cent, payable on capital increased by 882,000 new shares last June. Newman Industries 2s shares were quoted at 2s 3d following the preliminary statement of the results for last year. Net profits at £37,000 (after tax) are £4,000 below those of 1956, but provide comfortably for the maintenance of the dividend at 10 per cent, on which basis the yield on the shares is over 8¾ per cent.

Southern Areas

A noteworthy movement in electrical share prices over the past week or two was the recovery in Southern Areas Corporation £1 shares from about 10s to 13s 3d. This company, whose subsidiaries now cover an extensive range of domestic and industrial electrical equipment, is among those expected to announce the annual results during the first half of the present month. On the last two occasions the company has paid dividends at the rate of 7½ per cent to which it was reduced, from 10 per cent, in 1955. On that basis the yield on the shares is a fraction under 11 per cent. They were quoted up to 20s at times last year, and previously had stood as high as 38s.

REPORTS and DIVIDENDS

The Telegraph Construction & Maintenance Co., Ltd.—The report and accounts for 1957 now issued confirm the preliminary figures given in our last issue. In his review of the year, Sir John Dean (chairman) says that turnover showed a slight increase over that for 1956, but, in making this comparison, it must be borne in mind that the price of copper fell from £260 per ton in January to £180 per ton in December. This means an increase in volume of turnover of nearly 10 per cent. Exports, too, have been well maintained.

Dealing with the various groups in the company, Sir John says that the benefit of the economies which have been achieved by the cables group has been offset to a substantial extent by a reduction at the Greenwich works in the output of Submarine Cables, Ltd., which, although a separate company, nevertheless shares many of the facilities of the Greenwich works. Further economies which will be realised, coupled with increased demands for specialised copper products and a budgeted increase in cable sales, should show even better results during 1958. The group has succeeded in attaining a moderate profit, but there is no doubt that on the whole the cable industry of Great Britain is over-equipped in relation to demand. Some form of integration and rationalisation within the industry is desirable, and in this connection the directors are actively engaged in endeavours to improve the position. If European Free Trade Area discussions develop as is anticipated, rationalisation in the industry is vital. The company is a founder member of the Electric Cable Makers' Federation which has been formed to provide a body for the discussion of matters of common interest to all cable makers.

Submarine Cables, Ltd. (jointly owned with Siemens Edison Swan, Ltd.), is suffering to some extent from the Treasury "squeeze" and the consequent drop in orders, though this is not seriously reflected in the trading result of the year, during which the company completed a substantial portion of the new cable from San Francisco to Honolulu. It is now actively engaged in the manufacture of over 2,000 miles of a new transatlantic cable from North America to France. Whilst the long-term prospects of this company are fair, profits are likely to be somewhat meagre in relation to the specialised nature of the business and reliability and quality expected. There is reason to anticipate, however, that the income they receive from this business, which this year amounts to a gross figure of £87,384, will be maintained. The fact that there has been for so long a very large claim outstanding for the first Atlantic telephone cable has made the financing of Submarine Cables, Ltd., extremely difficult. Sir John refers to the successful year of the metals group and the plastics division and to developments in the company's overseas business.

Aberdare Cables (Holdings), Ltd.—In his statement for 1957, presented at the annual meeting on 25th April, Sir John Pascoe (chairman) says that the amount of cable manufactured was slightly in excess of that of the previous year. They have maintained their proportion of the export trade although opportunities in this field are increasingly difficult due to the establishment of indigenous manufacture in many countries. The amount of work in hand leads them to expect that the results of the current year will not differ greatly from those of last year.

New records have been established by South Wales Switchgear, Ltd., in the number and value of orders received, output achieved and work in hand. The outstanding feature is the extensive demand for new products, particularly the outdoor 33,000 V package station metalclad switchgear. This switchgear now includes 15,000 V equipment and there has been an expansion in the 11,000 V range, with particular reference to power station auxiliary switchgear. Their experience in transformers has not been dissimilar to that in switchgear. Their South African subsidiary, South Wales Electric (Pty.), Ltd., is making satisfactory progress and additional capacity has been acquired to deal with the increased flow of work. They have received a dividend from the Canadian associated company, Electric Switchgear (1953), Ltd. The factory output of Aberdare Engineering, Ltd., has been well maintained, as has also that of the Ivor Power Speciality Co., Ltd. Invoicings of Neckar Water Softener, Ltd., were in excess of the previous record year. Orders received included plant for the United Kingdom Atomic Energy Authority and the C.E.G.B. They commence the current year with a satisfactory order book.

The Telegraph Condenser Co., Ltd.—The trading results for 1957 were given in our issue of 28th March. Mr. D. W. Aldridge (chairman) says in his circulated statement that the major part of the decrease in trading profit is due to the acquisition in 1957 of a majority interest in a new Canadian subsidiary, the accounts of which have been consolidated. Profits of the holding company have been substantially maintained and output, particularly during the second half of the year, has continued at a satisfactory level, manufacturing facilities in most departments being fully employed. Turnover showed an increase over 1956, the demands for those types of capacitors used in the manufacture of sound reproduction apparatus and television reaching a particularly satisfactory level. Business with several overseas countries increased despite intense local competition. Expansion in turnover has not been reflected in the trading profits. Competition has remained keen and profit margins have narrowed once again; for certain products prices obtainable have now become quite unrealistic.

During recent years the Canadian business has been transacted through an agent, but a Canadian company has been formed with their company as major shareholder and the Canadian distributor as minority shareholder, to handle both the manufacturing and merchandising activities in Canada. In 1957 this company sustained a trading loss, partly due to non-recurring expenses inseparable from the setting up of a new factory, and partly to depressed trading conditions in that country. Since the beginning of the current year, however, there has been some increase in demand and the directors anticipate improved results for 1958. At the beginning of the current year they acquired the entire share capital of the United Insulator Co., Ltd., which manufactures ceramic bodies for certain types of capacitors, fuses and insulating materials, and various ceramics for non-electrical purposes.

Babcock & Wilcox, Ltd., report a group profit for 1957 of £3,865,812, as compared with £3,668,461 for 1956, and after deducting £2,089,951 for taxation, the net balance is £1,775,861 (against £1,547,216). It is proposed to pay a final dividend of 6¼ per cent on increased capital, making with the 7 per cent interim dividend paid before a one-for-four rights issue, a total of 13¾ per cent for the year (against 15 per cent).

Elliott-Automation, Ltd.—This company was formed in 1957 to merge Elliott Brothers (London), Ltd., and Associated Automation, Ltd. It reports that profits for 1957, before deducting depreciation and taxation, amount to £1,139,934. Depreciation accounts for £229,603 and taxation £498,680, leaving a net balance of £411,651. From this is deducted £232,462, the proportion applicable to the seven months before the merger, leaving a balance attributable to the company for five months of £179,189. Of the pre-acquisition profits £113,612 was applied in dividends by the two companies under the amalgamation scheme and £118,850 is retained in capital reserves. Elliott-Automation is paying a dividend of 4½ per cent for the five months and £96,426 is carried forward.

Blaw Knox, Ltd.—In the course of his review of 1957, Mr. J. M. Wallace (chairman) says, in referring to the transmission tower side of the business, that during the past year steel supplies have progressively improved and this situation is reflected by a sales increase of a substantial amount. Export sales improved last year and orders received to date are sub-

stantially increased despite keen competition. Unfulfilled home orders stand at an even higher level than at the end of 1956 due to large orders placed by the C.E.G.B.

Newman Industries, Ltd. — The group profit for 1957, subject to audit, amounts to £163,156, as compared with £202,669 for 1956, and the net balance, after meeting all charges, including £34,000 for taxation, is £36,660 (against £41,216). The ordinary dividend for the year is maintained at 10 per cent and a participating dividend of 2 per cent is paid on the preferred ordinary, making 8 per cent for the year (unchanged). Capital reserve receives £3,835 and the balance carried forward is £185,703 (against £168,802 brought in).

Parnall (Yate), Ltd.—The accounts for 1957 show a group profit of £438,439, as compared with £374,629 for the previous year, and after deducting depreciation and £177,510 for taxation, the net profit is £132,249 (against £135,752). Reserve for contingencies receives £50,000 and the dividend for the year is unchanged at 12 per cent.

Simon-Carves, Ltd., reports group profits for 1957 of £1,408,585, as compared with £1,374,024 for the preceding year, and after providing £704,785 for taxation, the net balance is £703,800 (against £665,749). The profit attributable to the parent company is £669,967 (against £686,416). Revenue reserve receives £253,884 and it is proposed to pay a final dividend of 17½ per cent (against 12½ per cent), making 25 per cent (20 per cent) for the year.

Laurence, Scott & Electromotors, Ltd.—The trading profit for 1957 amounts to £1,031,207, as compared with £996,656 for the preceding year, and after providing £430,000 for taxation, the net balance is £395,043 (against £392,256). It is proposed to pay a dividend of 15 per cent for the year on the £1,102,740 combined "A" and "B" ordinary capital. For 1956 the dividend was 15 per cent on capital of £882,190 before a one-for-four "rights" issue.

Pye, Ltd.—Stockholders are being offered £2½ million of 6 per cent debenture stock, 1976-81, at the price of 98 per cent. The proceeds are to be devoted to the repayment of bank overdrafts and for financing the business.

T. Clarke & Co., Ltd.—The profit for 1957, after deducting £40,728 for taxation, is £36,635, as against £36,899 for 1956. The dividend for the year is maintained at 16 per cent by a final payment of 8 per cent.

Sturtevant Engineering Co., Ltd.—The group profit for 1957 amounts to £530,270, as compared with £793,938 for 1956. Taxation absorbs £303,825 and the net profit is £226,445 (against £375,463). General reserve receives £117,000 and it is proposed to pay a final dividend of 12 per cent, maintaining the distribution for the year at 15 per cent, free of tax.

The Superheater Co., Ltd.—The consent of the Capital Issues Committee has been obtained for the capitalisation of £463,050 of reserves in a one-for-one scrip issue. The issue will be in the form of ordinary shares to the ordinary shareholders and "A" ordinary shares to "A" ordinary holders.

The British Vacuum Cleaner & Engineering Co., Ltd., reports a group profit, after taxation, of £34,345 for 1956-57 (against £23,834 for 1955-56), of which £8,164 (£935) is attributable to the holding company after deduction of outside sources. An ordinary dividend of 10 per cent (same) is recommended.

Cable & Wireless (Holding), Ltd., has declared an interim dividend of 2½ per cent (unchanged) on capital increased by a 10 per cent scrip issue.

Aerialite, Ltd., has declared an interim dividend of 20 per cent (against 19 per cent).

The Electrical Apparatus Co., Ltd., is paying an interim dividend of 4½ per cent (against 7½ per cent) on doubled capital.

New Companies

Electrical Components, Ltd.—Registered 15th April. Capital £50,000. Manufacturers of and dealers in electrical accessories, etc. Directors: A. T. Haywood, C. C. Scott, N. L. Allen, W. T. Hall, G. H. Wells, A. S. Seccombe, H. G. Baylis and W. J. Elliot. Regd. office: Components House, Ludgate Hill, Birmingham.

It will be recalled that the original company recently changed its name to Electrical Components (Holdings), Ltd., to act as parent company of its four subsidiaries, which includes the new company.

F.G.L. (Construction), Ltd.—In the note covering this company's registration in last week's issue the objects were broadly stated. We are now informed that the company will not be concerned with electric lighting, heating, radio or television; it is to manufacture multi-motor control panels.

Ham & Knight, Ltd.—Registered 3rd April. Capital £500. To acquire the business of radio, television and electrical engineers carried on by R. A. Ham and D. W. H. Knight at The Square, Storrington, Sussex, as Ham & Knight, etc. Directors: R. A. Ham and D. W. H. Knight. Regd. office: 2, Marlborough Place, Brighton.

Easi-Home (Domestics), Ltd.—Registered 3rd April. Capital £1,000. Manufacturers of and dealers in electrical equipment, apparatus, etc. Directors: W. J. Baker, Sadie Baker and Gladys M. Brazil. Regd. office: Portugal Street Works, Poland Street, Manchester, 4.

Wenbrook Controls, Ltd.—Registered 22nd April. Capital £200. Electrical engineers, designers, manufacturers of and dealers in mechanisms primarily concerning the control of electrical and mechanical power, etc. Directors: E. Howbrook and F. Howbrook. Regd. office: 15, Ullswater Road, Burnley, Lancs.

Cyril Exelby, Ltd.—Registered 15th April. Capital £500. Electrical engineers and contractors, electricians, radio and television engineers, etc. Directors: C. Exelby and Frances A. R. Exelby. Regd. office: 100, Town Street, Bramley, Leeds, 13.

N.S.D. Products, Ltd.—Registered 15th April. Capital £1,000. Manufacturers and repairers of and dealers in electronic and mechanical and electrical equipment, etc. Solicitors: Wm. White & Co., 76, Bishops Bridge Road, W.2.

Cambridge Works, Ltd.—Registered 28th March. Capital £10,000. Manufacturers of and dealers in radio sets, component parts, etc. Solicitors: Few & Kester, Cambridge.

Liquidations

J. M. Hanbury & Co., Ltd., manufacturers of electrical and fancy goods, 50, The Terrace, Torquay.—Winding up voluntarily. Liquidator, Mr. J. E. Ellis, 50, The Terrace, Torquay, appointed 9th April. Particulars of claims to the liquidator by 31st May.

R.E.C. Electrical Engineering Co., Ltd., radio and electrical engineers and contractors, 26, Wavertree Road, Liverpool.—Winding up voluntarily. Liquidator, Mr. S. O. Henry, Parkin S. Booth & Co., 5, Rumford Place, Liverpool, 3, appointed 11th April.

St. Mary's (Scilly) Electricity Supply Co., Ltd.—Winding up voluntarily by means of a members' voluntary winding-up. Liquidator, Mr. G. O. Redfearn, Alverton Manor, Penzance, Cornwall, appointed 10th April. Particulars of claims to the liquidator by 24th May. This notice is purely formal. All claims have been or will be paid in full.

Bankruptcies

G. G. Brittain, 1, Bromley Common, Bromley, Kent, radio, television and electrical engineer and retailer.—Receiving order made 11th April on debtor's own petition.

G. B. Barnes, 23, Front Street, Brampton, Cumberland, trading as A.B.C. Electrical Co., radio and electrical engineer.—Public examination 2nd June at the County Court Office, 39, Lowther Street, Carlisle.

A. E. R. Honey, 48, Bramerton Road, Beckenham, Kent, 117, Anerley Road, Penge, London, S.E.20, and formerly of 13, Longton Grove, Sydenham, London, S.E.26, carrying on business in partnership with another under the style of A. E. Honey, electrical contractors.—Application for discharge to be heard on 15th May at the County Court, Scarbrook Road, Croydon, Surrey.

T. Evans, 25, North Parade, Aberystwyth, Cardiganshire, trading as Tom Evans Electricals, electrical engineer.—Receiving order made 17th April on debtor's own petition.

T. A. Flowers, residing and lately carrying on business at 20, Riversdale Road, West Cross, Swansea, electrical contractor and sales representative.—Public examination 19th June at the Law Courts, Guildhall, Swansea.

Electronics in Industry

The British Thomson-Houston Co., Ltd., has issued a new publication (G13026) indicating the range of the company's electronic control equipment which is available to industry, although it does not cover all the types of electronic devices and systems made by the company. As manufacturers of electrical motors, generators, contactor equipment, gearing, etc., often included in an electronically controlled process, the company is able to supply a complete system with the correct choice and correlation of the various items which will function successfully with electronic apparatus. Moreover, the company develops and manufactures many of the valves used. Professional engineers are invited to write to the B.T.H. Co. for copies of the publication.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

17th April to 19th October

BRUSSELS. — Universal and International Exhibition.

Monday, 5th May

BIRMINGHAM.—James Watt Memorial Institute, Great Charles Street, 6 p.m. I.E.E. South Midland Centre. "Electrical Control of Stage and Television Lighting," by F. P. Bentham.

ILFORD.—Angel Hotel, 8 p.m. A.S.E.E. North East London Branch. "The Work of the Public Health Department," by Dr. I. Gordon.

LEEDS.—Great Northern Hotel, 7.30 p.m. A.S.E.E. Leeds Branch. "Silicones," by R. Nattras.

LONDON.—White Hall Hotel, Bloomsbury Square, W.C.1, 6.30 p.m. A.S.E.E. Central London Branch. Film or talk.

SHEFFIELD.—Royal Victoria Station Hotel, 7.30 p.m. A.S.E.E. Sheffield Branch. "Application of Flameproof Electrical Equipment."

STAFFORD.—Swan Hotel, 7 p.m. I.E.E. North Staffs. Sub-Centre. Annual general meeting, followed by "The Development of Variable-Speed High-Power Drives for Large Wind Tunnels" and "A Variable-Frequency Power Installation for Large Wind-Tunnel Drives," by P. McKearney, L. S. Drake and R. G. Mallalieu; "Speed Control of Large Wind Tunnels with particular reference to the R.A.E. 8ft by 8ft High-Speed Wind Tunnel," by L. S. Drake, J. A. Fox and G. H. A. Gunnell; and "Automatic Setting of the Flexible Walls of a Large Wind Tunnel," by T. Barnes and C. R. Dunham.

SWANSEA.—Demonstration Theatre, South Wales Electricity Board, The Kingsway, 6.30 p.m. I.E.S. Swansea Group. Informal meeting.

Monday, 5th May, to Saturday, 10th May

LONDON.—Olympia. International Hospital Equipment and Medical Services Exhibition.

Tuesday, 6th May

BELFAST.—Queen's University, 6.30 p.m. I.E.E. Northern Ireland Centre. Annual general meeting.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Centre. Annual general meeting.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Measurement and Control Section. "Some Case Histories of Business Computers in the U.S.A.", by Dr. A. T. Starr.

At the Royal Society of Arts, John Adam Street, Adelphi, W.C.2, 7 p.m. Incorporated Plant Engineers, London Branch. "What Management Requires of a Plant Engineer," by W. J. Worsdell.

MANCHESTER.—Engineers' Club, 17, Albert Square, 6.15 p.m. I.E.E. North-Western Centre. Annual general meeting, followed by "Supply Voltage and Current Variations produced by a 60-ton, 3-phase Electric Arc Furnace," by Dr. B. C. Robinson and A. I. Winder.

PETERBOROUGH.—White Lion Hotel, Church Street, 7.30 p.m. Incorporated Plant Engineers, Peterborough Branch. "Engineering Problems in the Beet Sugar Industry," by K. Hample.

READING.—Agricultural Hall, 121, Oxford Road, 7.15 p.m. A.S.E.E. Oxford, Reading and Districts Branch. "Electrostatic Precipitation."

Wednesday, 7th May

BIRMINGHAM.—James Watt Memorial Institute, Great Charles Street, 7 p.m. Junior Institution of Engineers, Midland Section. "Protective Relays," by H. S. Lewis.

BRIGHTON.—S.E.E.B. Offices, Castle Square, 5.30 p.m. E.I.B.A. Sussex Centre. Annual general meeting.

CARDIFF. — Park Hotel and Whitehall Rooms. Combustion Engineering Association, Cardiff Branch. 10.30 a.m. "Back Pressure Generation," by P. F. Morgan; 2.30 p.m. "Planned Maintenance," by T. W. Fishlock.

GLASGOW.—39, Elmbank Crescent, 7 p.m. I.E.E. South-West Scotland Sub-Centre. Annual general meeting.

At the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, C.2, 7.30 p.m. A.S.E.E. Glasgow Branch. Annual general meeting.

HALIFAX.—A.S.E.E. Halifax Branch. Tour of the works of the North Eastern Gas Board.

LONDON.—I.E.E. London Graduate and Student Section, 2 p.m. Communications equipment. Visit to London Airport.

Savoy Hotel, W.C.2, 12.30 for 1 p.m. Electrical Research Association. Annual luncheon.

At the Institution of Civil Engineers, Great George Street, S.W.1, 5.30 p.m. Institute of Fuel. "Improved Sampling Equipment for Solids in Flue Gases," by P. G. W. Hawksley, S. Badzioch and J. H. Blackett.

MANCHESTER. — Engineers' Club, Albert Square, 7 p.m. A.S.E.E. Manchester Branch. "Earth Leakage Protection of Electrical Installations," by J. A. Robbins.

PRESTON. — N.W.E.B. Demonstration Theatre, Friargate, 7.15 p.m. I.E.E. North Lancashire Sub-Centre. Annual general meeting, followed by "Electrical Floor Warming," by J. W. Moule and W. M. Stevenson.

R.A.F.A. Club, East View, 7.30 p.m. A.S.E.E. Preston Branch. "Outdoor Illumination," by H. Carpenter.

SOUTHAMPTON.—Polygon Hotel, 7.30 p.m. Incorporated Plant Engineers, Southern Branch. "The Generation of Power from Atomic Energy," by H. R. M. Hyder.

Wednesday, 7th May, to Saturday, 17th May

LONDON.—Earls Court. Mechanical Handling Exhibition.

Thursday, 8th May

DUNDEE.—Queen's College, 7 p.m. I.E.E. North Scotland Sub-Centre. Annual general meeting.

GLASGOW. — Scottish Building Centre, 425/427, Sauchiehall Street, 7.15 p.m. Incorporated Plant Engineers, Glasgow Branch. "Oil Firing as Applied to Steam Raising Plant," by A. W. Rooney.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Utilisation Section. "Artificial Fibres," by Dr. P. T. Standring.

TORQUAY.—Electric Theatre, Union Street, 3 p.m. I.E.E. South-Western Sub-Centre. "Preventive Maintenance," by P. L. Lutte and A. G. Milne.

Friday, 9th May

LONDON.—Savoy Place, 6 p.m. I.E.E. Education Discussion Circle. Discussion on "The Teaching of Applied Acoustics," opened by G. Mather.

Feathers Hotel, Broadway, Westminster, 6 p.m. Electrical Trade Commercial Travellers' Association. "Personal Wartime Escape Experience," by Major Gordon Instone.

Friday, 9th May, to Sunday, 11th May

SCARBOROUGH. — Spa Theatre. National Industrial Safety Conference.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 9th May:—

ASTRAL. No. 767,769. Class 7. Domestic electric machines for vegetable-cleaning, vegetable-peeling, mixing, mincing, clothes washing, ironing, and for hair-drying, and parts.—Astral Equipment, Ltd., Industrial Estate, Kingsway, Dundee.

HOTPOINT COUNTESS. No. 772,026. Class 7. Domestic washing machines, and parts.—Hotpoint Electric Appliance Co., Ltd., Crown House, Aldwych, London, W.C.2.

GECOLITE. No. 768,079. Class 9. Parts of scientific, electrical and electronic apparatus and instruments, all made wholly or principally of magnetisable oxidic materials.—General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

FISHCLICK. No. 768,933. Class 9. Scientific and electrical apparatus and instruments; nautical apparatus and instruments; radio, signalling and echo-sounding apparatus; electrically operated warning devices, being fittings for echo-sounding apparatus to indicate the reception of echoes; and parts.—Pye Marine, Ltd., Lowestoft.

SPECTROSIL. No. 771,136. Class 9. Electrical, electro-technical, laboratory and scientific apparatus and instruments; optical, measuring and photographic apparatus and instruments; electric conduit material, electronic discharge tubes (not for lighting purposes), electric semi-conducting devices; electric heating elements, industrial chemical apparatus and domestic electric appliances; and parts.—Thermal Syndicate, Ltd., Neptune Bank, Wallsend-on-Tyne.

WANDLE. No. B770,811. Class 9. Connections, terminals, shunt boxes, junction boxes, conduits, switches and switchboards; electrical apparatus and instruments, etc. WANDLE. No. B770,812. Class 11. Heating apparatus and heating materials, all being electric; guard devices for lighting and heating apparatus and appliances; globe protectors for lamps; electric torches; ventilation apparatus, etc.—Wandleside Cable Works, Ltd., 106, Garratt Lane, Wandsworth, London, S.W.18.

MY LADY ELIZABETH. No. 772,615. Class 9. Radio telephone, television and telegraphic apparatus, gramophones, and parts; electric batteries; and cases for electric torches and electric pocket lamps.—Vidor, Ltd., 681, Salisbury House, Finsbury Circus and London Wall, London, E.C.2.

MYGRACE (design). No. 773,191. Class 9. Nautical, surveying, navigating, optical, radio, radar, television, signalling, teaching and measuring apparatus and instruments; scientific, electrical and electronic apparatus and instruments; and parts.—A. K. Smith & L. G. Smith, Ltd., 29, Ferguson House, Blackheath Hill, London, S.E.10.

CAROUSEL. No. 773,375. Class 9. Radio, television and sound reproducing apparatus and instruments. — Brighouse Television Finance, Ltd., 12/14, Wakefield Road, Brighouse, Yorks.

HMV. No. 769,840. Class 10. Electric blankets.—Gramophone Co., Ltd., Blyth Road, Hayes, Middx.

SPIROMIC. No. 771,099. Class 11. Electric installations for heating.—A. & R. Electric Co., Ltd., Bruce Avenue, Shepperton, Middx.

ROTISS-O-MAT. No. 772,679. Class 11. Electrical installations for cooking poultry, and parts.—Harley Manufacturing Corporation, New York, U.S.A. Address for service, c/o Seaton Taylor & Co., 11, John Street, Bedford Row, London, W.C.1.

AMP (design). No. 766,047. Class 17. Plastics in the form of tubes, sheets and shaped pieces; and electric insulators and insulating materials.—Amp Incorporated, Harrisburg, Penn., U.S.A. Address for service, c/o Urquhart-Dykes & Lord, Maxwell House, 11, Arundel Street, Strand, London, W.C.2.

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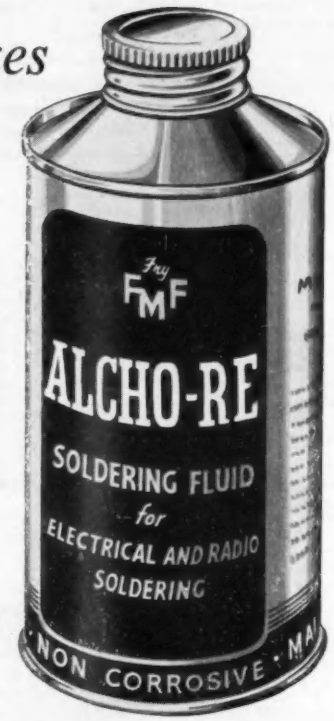

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NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) will be obtainable after 7th May from the Patent Office, 25, Southampton Buildings, London, W.C.2

1953

20504. Levane, R.—Device for locking electrical lamp bulbs in their holders. 25th October, 1954. (794492.)

29848. Standard Telephones & Cables, Ltd.—Electrical switching equipment employing crystal triodes. 22nd October, 1954. (794656.)

1954

10076. Pechiney Compagnie de Produits Chimiques et Electrometallurgiques.—Electrolytic cells. 6th April, 1954. (794421.)

11178. Kirby, H. D. B. (Siemens & Halske Akt.-Ges.).—Processes for the production of pure germanium and silicon. 15th April, 1954. (794641.)

19360. Fielding & Platt, Ltd., and Henley's Telegraph Works Co., Ltd., W. T.—Hydraulic extrusion apparatus. 22nd November, 1955. (794498.)

23538. Hoover, Ltd.—Suction cleaners. 13th August, 1954. (794721.)

24627. Lykke, G.—Electric rotor testing. 24th August, 1954. (794719.)

28374. British Thomson-Houston Co., Ltd.—Electrical pulse generators employing semi-conductor devices. 23rd September, 1955. (794425.)

32237. Stahl, A., Stahl, O., Stahl, O., and Stahl, B. (Stahl Maschinenfabrik, R.).—Multiple position electric switches. 8th November, 1954. (794568.)

35100. Ultra Electric, Ltd., and Willheim, R.—Magnetic amplifiers. 1st December, 1955. (794427.)

36467. Pye, Ltd.—Gain-controlled radio frequency or intermediate frequency signal amplifying circuits. 16th December, 1955. (794726.)

36558. Westinghouse Brake & Signal Co., Ltd., and Duckitt, H.—Electrical timing systems. 9th December, 1955. (794727.)

1955

1302. Roberts & Armstrong (Engineers), Ltd., and Armstrong, J.—Electrical measuring instruments. 12th January, 1956. (794728.)

6818. British Thomson-Houston Co., Ltd.—Winders. 7th March, 1956. (794507.)

7005. Ferranti, Ltd.—Variable liquid resistor devices. 8th June, 1956. (794508.)

7388. Radio Heaters, Ltd.—High frequency heating equipment. 5th March, 1956. (794510.)

14550. Plessey Co., Ltd.—Potentiometers or resistor elements. 17th May, 1956. (794575.)

14642. General Electric Co., Ltd.—Refractor members for lighting fittings. 1st May, 1956. (794670.)

17089. Wilco Products Proprietary, Ltd.—Electric plug fittings. 1st May, 1956. (794741.)

17189/90. Westinghouse Brake & Signal Co., Ltd., and French, E. L.—Selenium rectifier. 4th May, 1956. (794516 and 794577.)

18507. British Insulated Callender's Cables, Ltd.—Clips for elongated members and in overhead electric traction systems. 27th June, 1956. (794517.)

20911. General Electric Co.—Dynamo-electric machines. 19th July, 1955. (794743.)

21318. Landis & Gyr Akt.-Ges.—Three-phase four-wire induction meter. 22nd July, 1955. (794587.)

22173. Radio Heaters, Ltd.—High frequency heating equipment. 6th July, 1956. (794443.)

22698. Automatic Telephone & Electric Co., Ltd.—Circuit arrangements for converting information from one form to another. 13th July, 1956. (794745.)

22966. Canadian Airborne Geophysics, Ltd.—Electromagnetic prospecting apparatus. 9th August, 1955. (794746.)

23632. Svenska Ackumulator Aktiebolaget Jungner.—Electric cells. 16th August, 1955. (794592.)

23924. Imperial Chemical Industries, Ltd.—Waveguides. 10th August, 1956. (794748.)

24885. Century Lighting, Inc.—Lighting dimmers. 30th August, 1955. (794596.)

25072. General Electric Co., Ltd.—Methods of forming a junction in a semi-conductor. 30th August, 1956. (794674.)

25132. Telephone Manufacturing Co., Ltd.—Electric contact assemblies. 28th August, 1956. (794525.)

26494. Wild-Barfield Electric Furnaces, Ltd.—Inductors for heating cylinders. 10th September, 1956. (794598.)

26692. Westinghouse Electric International Co.—Electrical translating apparatus including a semi-conductor. 19th September, 1955. (794753.)

28808. British Thomson-Houston Co., Ltd.—Dynamo-electric machines. 21st September, 1956. (794756.)

29149. Ardenne, M. Von.—Electron precision oscillographs. 13th October, 1955. (794603.)

30011. Homma, J.—Electric fire alarm device. 20th October, 1955. (794759.)

30320. Marconi's Wireless Telegraph Co., Ltd.—Television transmission systems. 5th July, 1956. (794531.)

31778. Philips Electrical Industries, Ltd.—Control means for electric motors driving X-ray apparatus. 7th November, 1955. (794605.)

1956

1077. Kenmore, H.—Electrical communication wire. 12th January, 1956. (794456.)

4868. Compagnie Française Thomson-Houston.—Nuclear reactors. 16th February, 1956. (794614.)

6603. Standard Telephones & Cables, Ltd.—Multi-channel pulse communication systems. 2nd March, 1956. (794776.)

11312. Compagnie Générale de Télégraphie sans Fil.—Ultra-high-frequency tubes. 13th April, 1956. (794545.)

12160. Fansteel Metallurgical Corporation.—Hermetically sealed electrical apparatus containing liquids. 20th April, 1956. (794631.)

12358. General Electric Co.—Etching of titanium, zirconium, miobium and niobium tantalum alloy for capacitor electrodes. 23rd April, 1956. (794465.)

12795. Centre National de la Recherche Scientifique. — Ferromagnetic ceramic materials. 26th April, 1956. (794777.)

14291. Bendix Aviation Corporation.—Electronic computing system. 8th May, 1956. (794633.)

15781. Sulzer Freres Soc. Anon.—Steam power plants employing forced-flow steam generators. 22nd May, 1956. (794683.)

18122. General Electric Co.—Domestic ventilating fans. 12th June, 1956. (794655.)

18204. Bosch Ges., R.—Electrical condensers. 13th June, 1956. (794784.)

18936. Standard Telephones & Cables, Ltd.—Electric wave filters. 19th June, 1956. (794787.)

19762. General Electric Co.—Gaseous fuel electric cell. 26th June, 1956. (794471.)

20862. Philips Electrical Industries, Ltd.—Luminescent materials and screens. 5th July, 1956. (794638.)

22565. Corning Glass Works.—Electroconductive article. 20th July, 1956. (794794.)

23317. General Electric Co.—Vertical indicating instruments. 27th July, 1956. (794640.)

23748. General Electric Co.—Electric arc welding apparatus. 1st August, 1956. (794687.)

25109. Babcock & Wilcox, Ltd.—Tubulous vapour generators. 16th August, 1956. (794692.)

26084. Ford Motor Co., Ltd.—Motor vehicle electrical systems. 27th August, 1956. (794695.)

27810. Dow Chemical Co.—Galvanic anode installation. 11th September, 1956. (794698.)

29078. Allmanna Svenska Elektriska Aktiebolaget.—Excitation arrangement for synchronous generators. 24th September, 1956. (794799.)

29100. Electric Furnace Co.—Muffle type furnace with movable support struts. 24th September, 1956. (794800.)

29562. Babcock & Wilcox, Ltd.—Method of operating tubulous vapour generating and vapour heating units. 27th September, 1956. (794703.)

30000. Svenska Aktiebolaget Gasaccumulator.—A.c. motor. 2nd October, 1956. (794704.)

31875. Standard Telephones & Cables, Ltd.—Radio frequency microwattmeter. 19th October, 1956. (794706.)

34961. Aktiebolaget Svenska Fläktfabriken.—Collecting electrode of the so-called hollow box type for electrostatic precipitators. 15th November, 1956. (794475.)

1957

16937/8. Kirby, H. D. B. (Siemens & Halske Akt.-Ges.).—Processes for the production of pure germanium and silicon. 15th April, 1954. (Divided out of 794641.) (794642/3.)

Street Lighting Plans

The Ministry of Transport and Civil Aviation has indicated that the **Luton** Council's amended street lighting improvement scheme, costing £16,830, will be recommended for approval.

Lambeth Borough Council is recommended to approve the carrying out of Stage 9 of its scheme for the conversion of gas street lighting to electricity, at an estimated cost of £26,040.

Subject to Ministry approval, **Stratford-upon-Avon** Corporation proposes to provide trunk road lighting in Birmingham Road, Shipston Road and Evesham Road at an estimated cost of £4,696.

Middlesbrough Town Council has been informed that it will cost another £78,000 to complete the scheme for main road lighting. The work is to be spread over the next four years. Since the war, the Council has erected 1,268 street lamps on new housing estates, while more than 600 lamps have been erected on main roads.

Approval having been given by the Scottish Home Department, the re-lighting at a cost of £7,633 of the trunk road running through **Oban** will begin shortly. Fluorescent lamps will be used.

Sunderland Town Council is to replace the gas lighting on a section of the Ford estate with electricity. The cost will be about £7,000.

Wallsend Town Council has approved an amended scheme by the North Eastern Electricity Board for converting street lighting from gas to electricity. The cost will be about £15,000.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Aireborough.—U.D.C. 28th May. Street lighting equipment. (See this issue.)

Ealing.—Borough Council. 28th May. Sodium discharge lamps and reinforced concrete lighting columns. Borough surveyor, Town Hall, Ealing, W.5.

Ellesmere Port.—Corporation. 20th June. Illumination of speed restriction signs. (See this issue.)

Essex.—County Council. 10th May. Renewal of electrical installation at King Edward VI Grammar School, Chelmsford. (See this issue.)

Gateshead.—Corporation. 11th June. Electrical installation at secondary modern school for girls. (See this issue.)

Grimsby.—Borough Council. 28th May. Electrical installations, College of Further Education. Borough engineer, Municipal Offices, Town Hall Square.

Havant and Waterloo.—U.D.C. 14th May. Street lighting equipment. (See this issue.)

India.—Posts and Telegraphs Department, New Delhi. 28th May. Power plant for trunk cable scheme connecting Bombay, New Delhi and Calcutta. (E.S.B. 9994/58. Ten/32016.)*

Iran.—Plan Organisation, Tehran. 8th May. Electrification of the town of Rezaieh. 9th June. Electrification of the town of Astaneh. (E.S.B. 10054/58. Ten/32065.)*

Iraq.—Directorate General of Municipalities, Baghdad. Generating sets for a number of towns. (E.S.B. 10373/58. Ten/32056.)* Generating set and two transformers at Mandali. (E.S.B. 10371/58. Ten/32058.)*

Manchester.—Corporation. 19th May. Electrical installation at the main pumping station and the power station at Davyhulme sewage works. (See this issue.)

Middlesbrough.—Town Council. 9th May. Electric lamps and unit dry cells for one year to 30th June, 1959 (Form No. 43). Borough engineer, Municipal Buildings.

New Zealand.—Director-General (Stores Division), G.P.O. 9th June. Portable interference locators and noise and signal strength measuring sets. (E.S.B. 10577/58. Ten/32101.)* 10th June. Radio transmitter. (E.S.B. 10578/58. Ten/32100.)*

Northern Ireland.—14th May. Electrical installation in St. Aidan's Secondary Intermediate School, Glenavy, Co. Antrim. McLean & Forte, architects, 37, Malone Road, Belfast.

16th May. Electrical installation in extension to Thompson Memorial Primary School, Ballyrobert, Co. Antrim. Wm. J. Ogle, Associate I.E.E., consulting engineer, 63, Main Street, Bangor, Co. Down.

North of Scotland.—Hydro-Electric Board. Construction of 132 kV double-circuit steel tower transmission line between Craigiebuckler and Redmoss, near Aberdeen. (See this issue.)

Philippines.—National Power Corporation, Manila. 15th May. Transmission line conductors, insulators and line hardware for the Cawayan River No. 1 hydro-electric project. (E.S.B. 10319/58. Ten/32055.)*

Runcorn.—R.D.C. 12th May. Street lighting schemes. Engineer and surveyor, Castle Park, Frodsham, via Warrington.

Sheffield.—City Council. 4th June. Two centrifugal pumps with electric motors, control gear, fittings, etc., for Blackbrook Road pumping station. City engineer, Town Hall.

South Africa.—Stores Department, South African Railways, Johannesburg. 7th May. Lightning arrestors. (E.S.B. 10500/58. Ten/32083.)* 14th May. Busbar support insulators. (E.S.B. 10186/58. Ten/32035.)* 16th May. Armature coils for electric locomotives. (E.S.B. 10188/58. Ten/32053.)* 21st May. Switch fuses and isolating switches. (E.S.B. 10505/58. Ten/32081.)* Switches, socket outlets and lampholders. (E.S.B. 10502/58. Ten/32085.)* Power plant for carrier telephone apparatus. (E.S.B. 10506/58. Ten/32096.)* 23rd May. Steel conduit and flexible tubing. (E.S.B. 10509/58. Ten/32082.)* Main motor armature coils for locomotives, and insulation kits. (E.S.B. 10510/58. Ten/32087.)*

South West Africa.—Tender Board. Submersible electric pumps. (E.S.B. 10196/58. Ten/32033.)*

Thailand. — Telephone Organisation, Bangkok. 16th May. Telephone cable. (E.S.B. 10381/58. Ten/32067.)*

Wandsworth.—Borough Council. 21st May. Traction batteries. (See this issue.)

Warrington.—R.D.C. 2nd June. Five sets of sewage pumps and four sets of mixed flow vertical storm water pumps, with equipment, for Penketh and Great Sankey main drainage contract. John Taylor and Sons, consulting engineers, Artillery House, Artillery Row, Victoria Street, Westminster, S.W.1.

West Hartlepool.—Corporation. Renewal of electrical installation in Lister Street School. Plans, borough architect, Municipal Buildings, West Hartlepool.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Accrington.—Houses (60), Sandy Lane; L. Frankland, Ltd., builders, Church Street.

Bournemouth.—Concert hall, café, etc., at Bournemouth Pier; James Drewitt & Sons, Ltd., builders, Seabourne Road, Boscombe.

Bristol.—Shops and showrooms, Inner Circuit Road; Wm. Cowlin & Sons, Ltd., builders, Stratton Street.

Carlisle.—Church and hall, at Morton; Graham & Roy, architects, 6, Paternoster Row, Carlisle.

Douglas (Isle of Man).—Bus-air terminal in Lord Street; borough surveyor.

Dudley. — Secondary modern schools, Wrens Nest and Halesowen Road; borough surveyor, Council House.

Dunstable.—Shops and offices, West Street; Gavin Construction Co., Ltd., Freeland House, High Street, Cranleigh.

Ealing.—Four-storey offices on site of Orion Works, as part of scheme for extensions to Town Hall; borough engineer, Town Hall, London, W.5.

Exeter.—Showrooms and offices, High Street; Jack E. Dalling, architect, 53, St. Martin's Lane, London, W.C.2.

Goole.—Houses and flats (169), Old Goole slum clearance scheme; borough engineer, Municipal Offices.

Haverfordwest.—Flats (54), City Road; borough surveyor.

Ilford.—Shops, near Railway Station; Charterbridge Corporation, Ltd., 8a, Eccleston Street, London, S.W.1.

Johnstone. — Houses (36), Spring Grove, Kilbarchan; Scottish Special Housing Association, Ltd., 15-21, Palmerston Square, Edinburgh, 12.

Keighley. — Houses (133), Braithwaite estate; borough architect, College Street.

Kingston-on-Thames.—Modernisation of main block of Kingston Hospital (£45,000); secretary, South West Metropolitan Regional Hospital Board, 11, Portland Place, W.1.

Lanarkshire.—Secondary school at Tannochside; I. V. Patterson, county clerk, 191, Ingram Street, Glasgow.

Leicester.—Reconstruction of Royal Hotel, Horsefair Street; Everards Brewery, Ltd., Southgate Street.

Leominster.—Houses (40), Cranes Lane site; J. Brian Cooper, architect to Council, 38, Highfield Road, Edgbaston, Birmingham, 15.

London.—Flats (112), Ormond Close, Holborn; borough architect.

Special school, Fitzroy Park, St. Pancras; Stephen Gardiner, architect, 30, Elm Park Road, S.W.3.

Showrooms and offices, Arlington Street, Westminster; E. A. Stone, Toms & Partners, architects, 28, South Audley Street, W.1.

Four-storey premises for administrative, welfare and storage purposes, 1-5, Newington Causeway, Southwark; White & Traviss, architects, 104, High Holborn, W.C.1.

Malpas. — Secondary modern school (£95,000); county architect, County Hall, Chester.

Middlesbrough.—Hostel for medical staff at General Hospital (£13,000); G. H. Rogers, builder, North Road, Middlesbrough.

Houses (52), Easterside; J. A. Kenyon, borough engineer.

Mitcham.—Office block, Church Road, for Thomas Parsons & Sons, Ltd.; Cluttons, surveyors, 5, Great College Street, London, S.W.1.

Mountsorrel.—Dwellings (36), for Barrow-on-Soar R.D.C.; Council's architect, Barrow-on-Soar, Leics.

Newcastle-on-Tyne.—Twelve-storey blocks of flats at Shieldfield; city architect, 18, Cloth Market.

Northampton.—Workshop block for Central College of Further Education; A. Glen & Son, Ltd., builders, Chaucer Street.

North Riding.—Primary school at Marske; J. H. Napper, architect, 56, Eldon Place, Newcastle-on-Tyne.

Norwich. — Blackdale junior school (£57,728); D. Percival, city architect.

Oldham. — Large departmental store, Market Place; Littlewoods, Ltd., Waterloo Buildings, Cases Street, Liverpool.

Portsmouth.—College of Art (first phase); Howe & Bishop, Ltd., builders, Clarendon Street.

Rugby.—R.C. church, Bilton estate; Sandy & Norris, architects, The Studio, Newport Road, Stafford.

Saltburn. — Modern school for North Riding E.C.; Grenfell Baines Group, architects, Preston, Lancs.

Sedgley.—Workshops and offices; W. J. Handrahan & Son, Dudley Road.

Southampton.—Maternity unit for General Hospital; Gutteridge & Gutteridge, architects, 45, Westwood Road.

Sutton Coldfield.—Houses (127), Wylde Green Lane; Allton Estates, Ltd., 658, Chester Road.

Sutton Courtenay.—Primary school; Floyd, Robson & Paul, architects, St. Nicholas House, West Mills, Newbury.

Tenterden.—Houses (20), Wayside estate, St. Michael's; H. G. Hunt, architect, The Ingles, Hawkhurst.

Weston-super-Mare. — Factory, Locking Road, for C. & J. Clark, Ltd.; C. P. Unwin & Son, Ltd., builders, 33, St. Peter Street, Tiverton.

Wolverhampton.—School, Bee Lane, Bushbury; J. Brock Allon, town clerk, Town Hall.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

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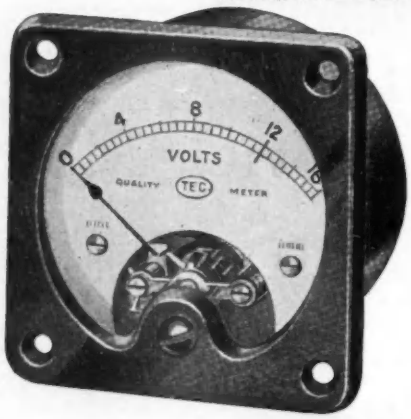

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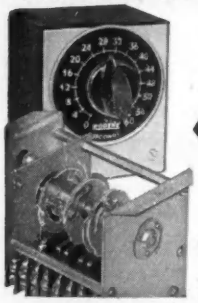

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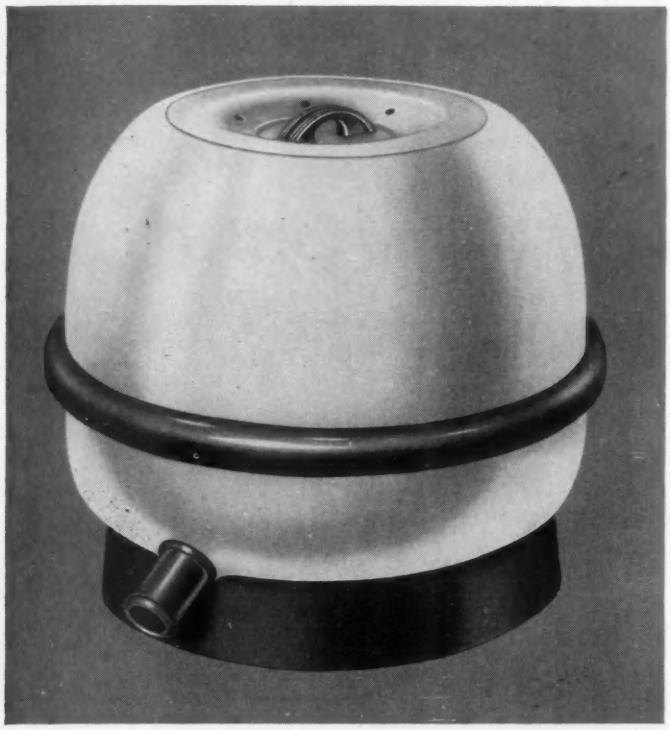

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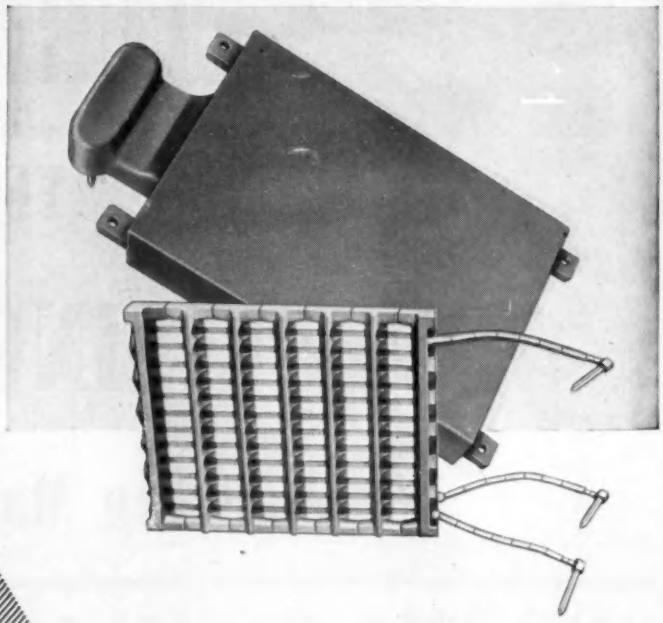

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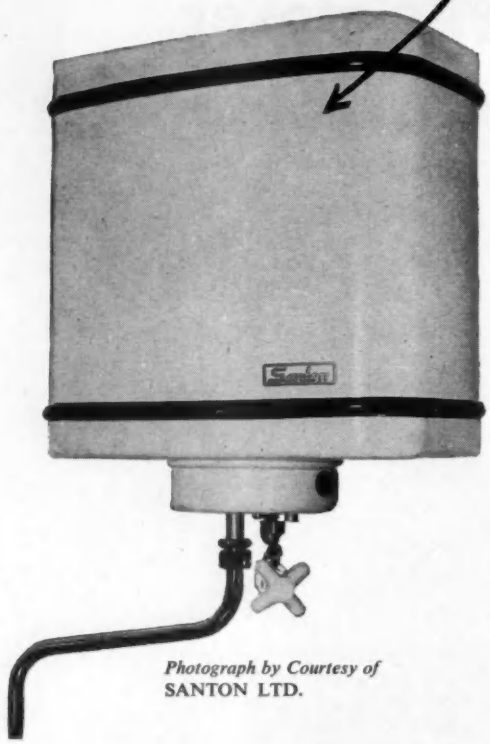

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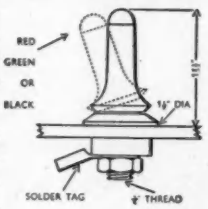

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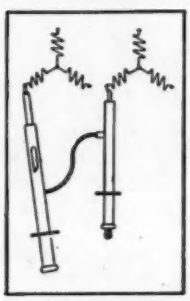

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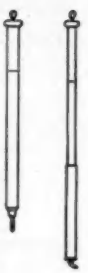

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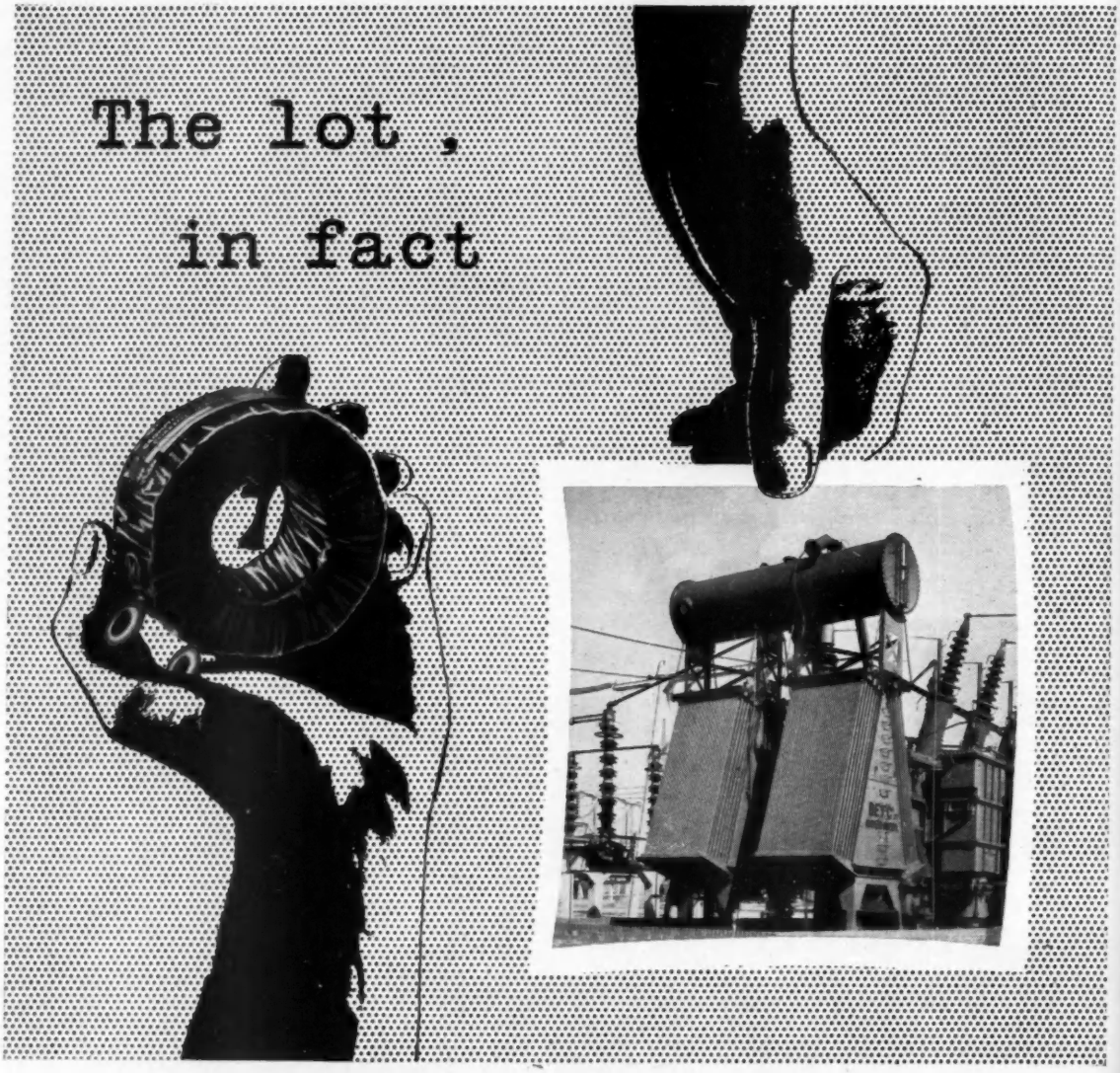

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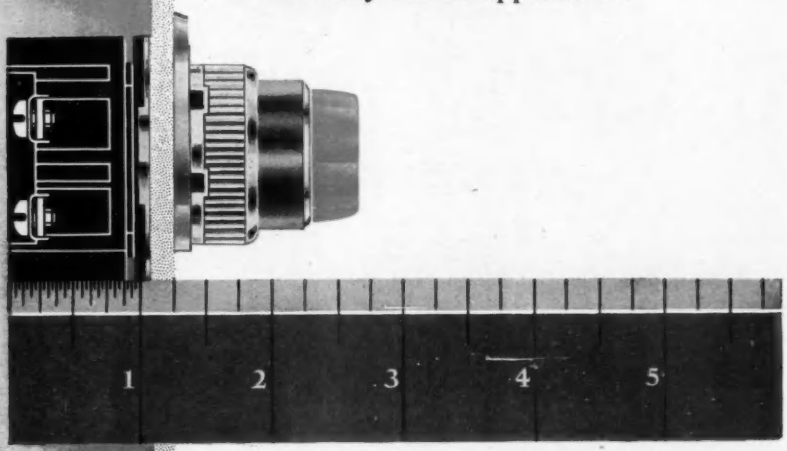

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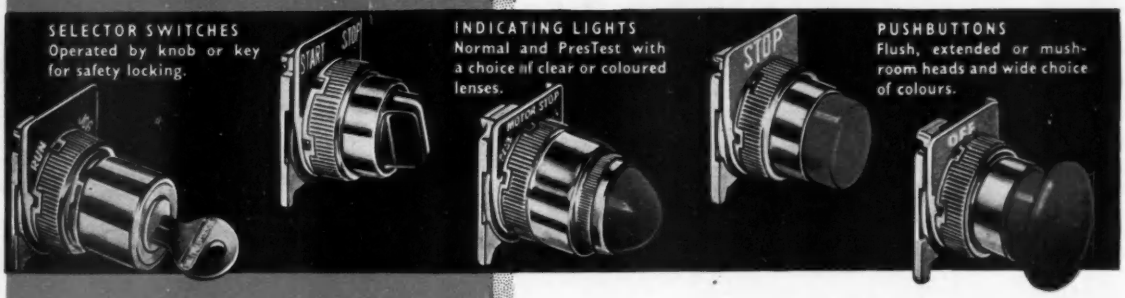

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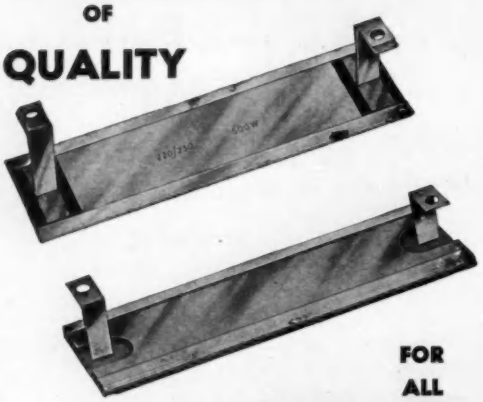

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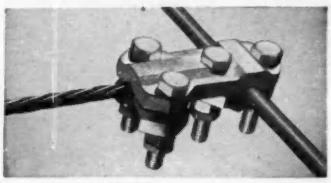

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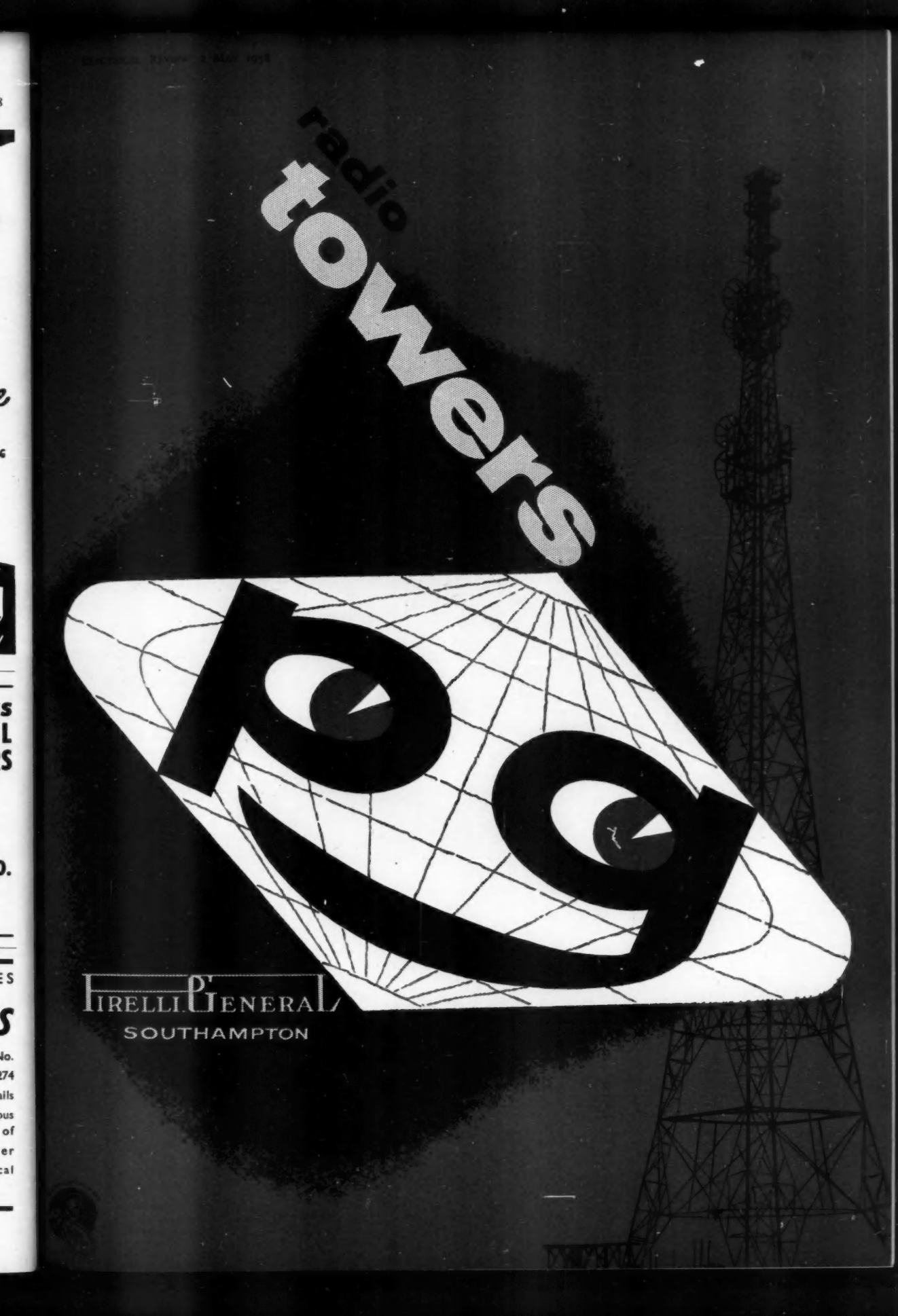
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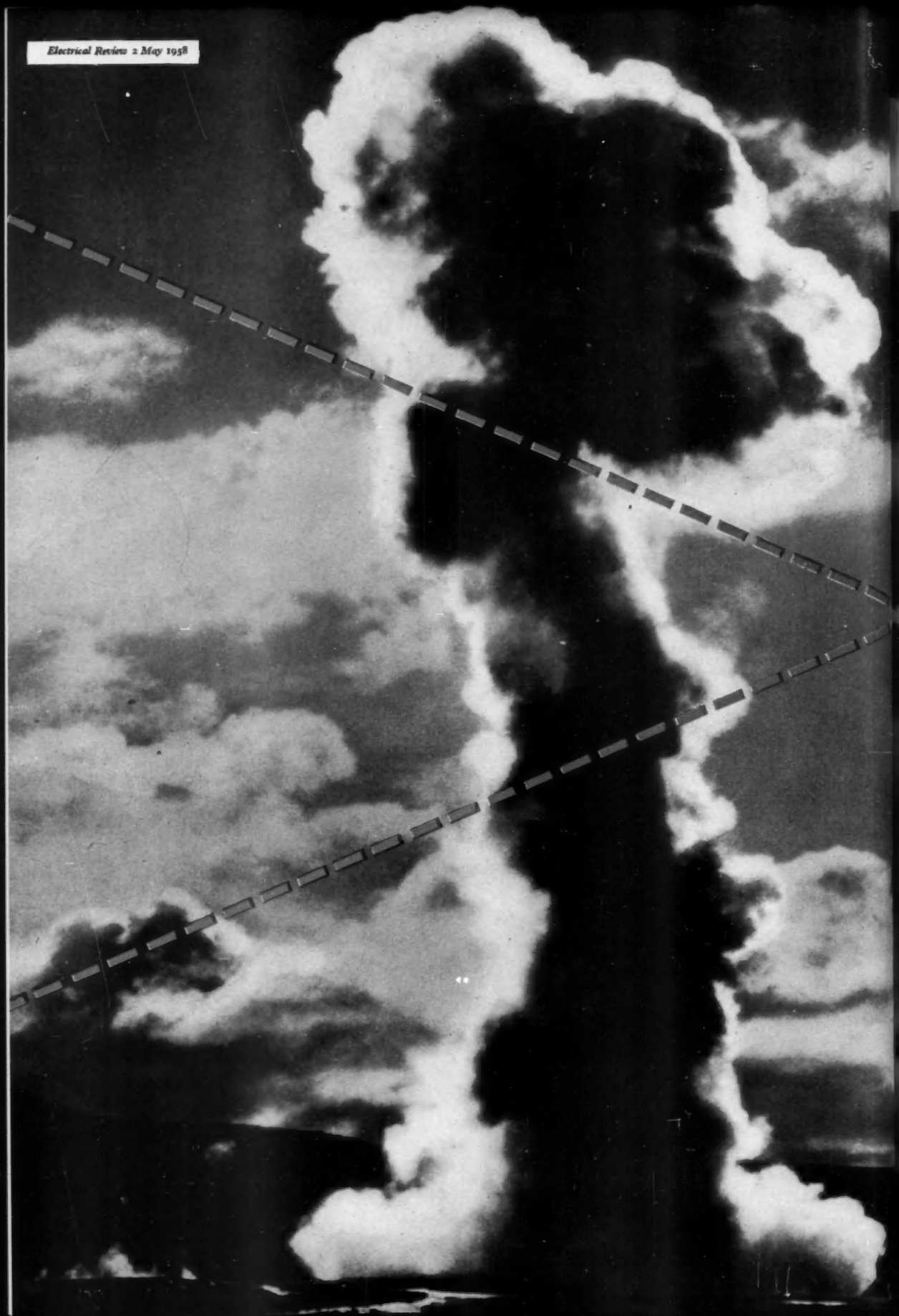
raw

raw power—refined control

Old Faithful, most famous of the geysers at Yellowstone Park. Such phenomena are within the scope of the observations of scientists of more than 50 nations throughout the International Geophysical Year. Photograph by courtesy of United States Information Service

one side of the picture — the raw, natural power; unharnessed, uncontrolled

and the other side? Simplex switchgear. Reliable and protective. The means by which raw power is controlled, directed, channelled. An ideal means, because Simplex take a workmanlike view of switchgear: use the best of the most suitable materials and methods. Produce a job that looks as good as it is. And above all — Simplex design for the man on the job — plan for utmost ease in installation, maintenance and adaption

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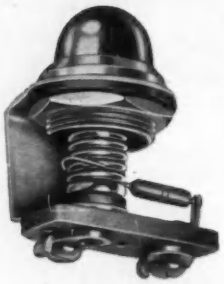
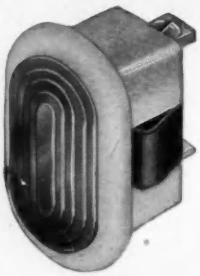


S.L.125

S.L.90/N



S.L.50

S.L.81

S.L.78

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S.L.50: Snap-in fixing. S.L.90/N: Has replaceable MES neon tube. S.L.125: A new design similar to the S.L.90/N but it has 5 BA screw terminals and built-in resistor.

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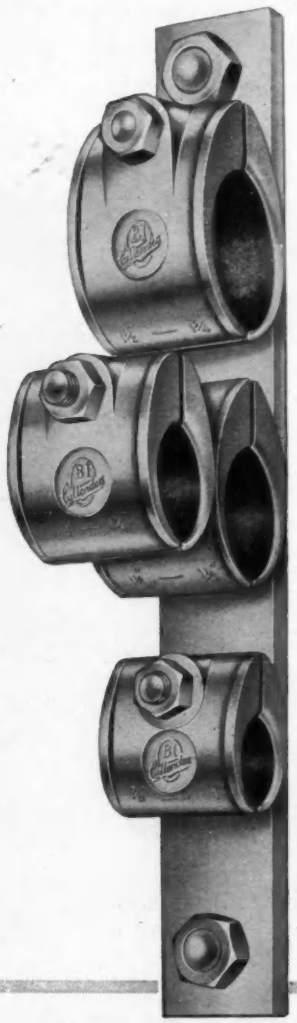

Here's why Claw-type Cleats can speed up your cable installations :—

They are light and strong, compact and space saving.

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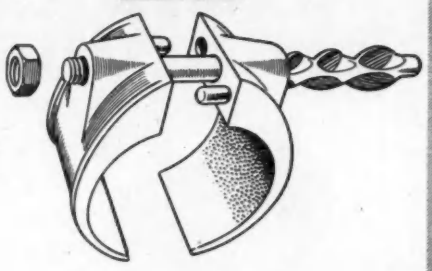
Easily accessible on multi-cable runs for making extensions or adaptations.



Claw-type Cleats can be used singly or in groups mounted on galvanised steel backstraps.

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A 10,200 Ampere-hour D.P. cell in a wood lead-lined box.

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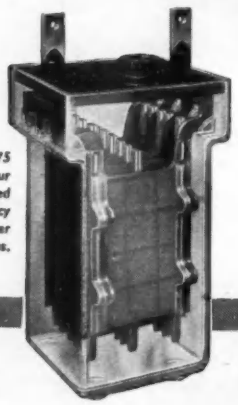

A sealed type 75 Ampere-hour D.P. Cell as used for emergency lighting and power stations.

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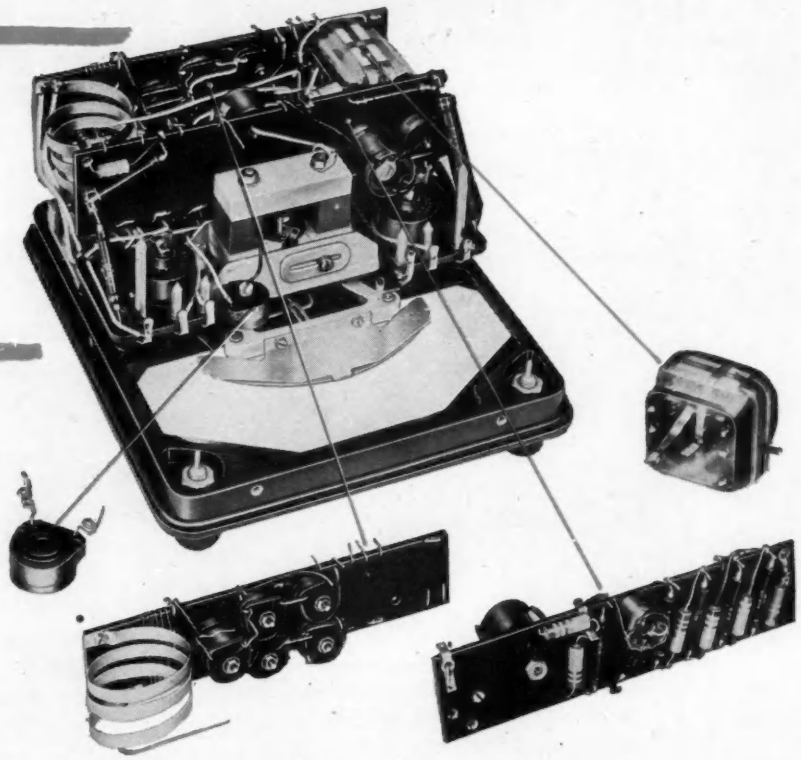

Araldite epoxy resins have a remarkable range of characteristics and uses.

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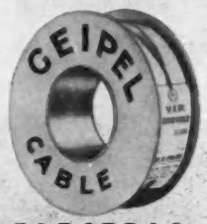

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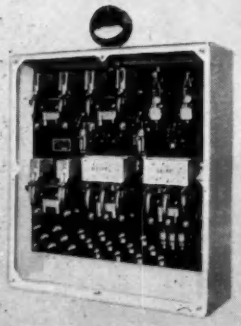

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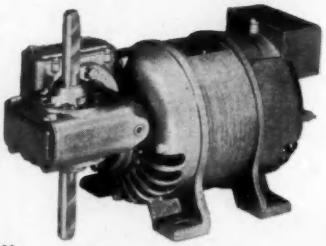

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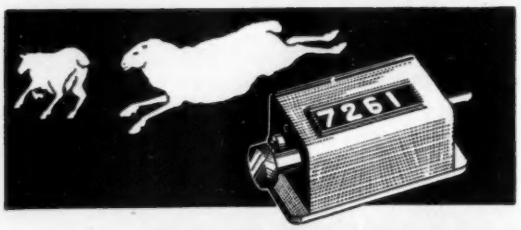

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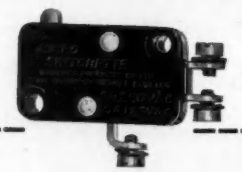

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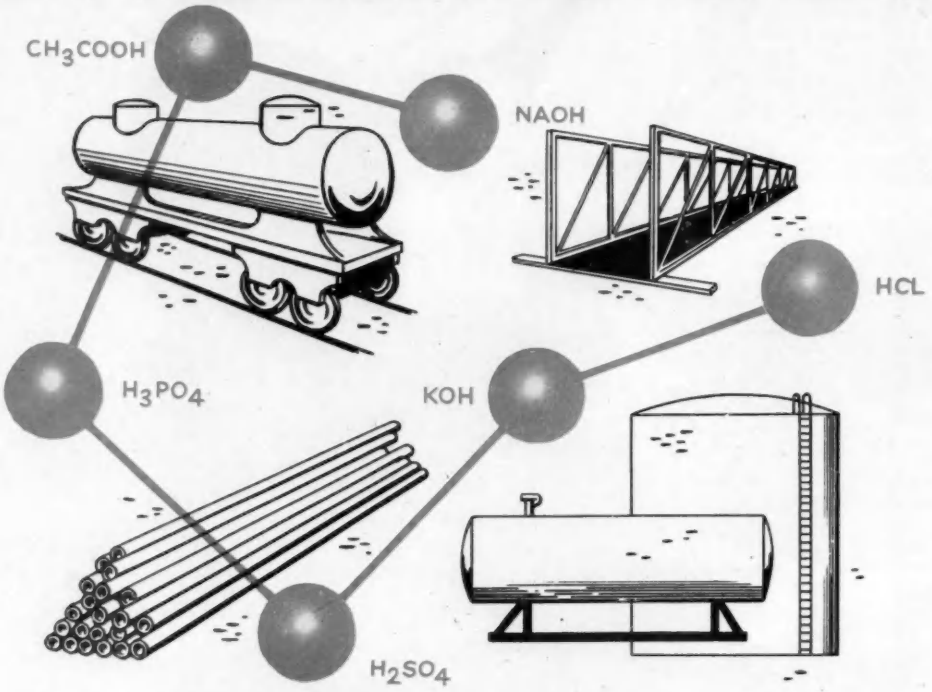

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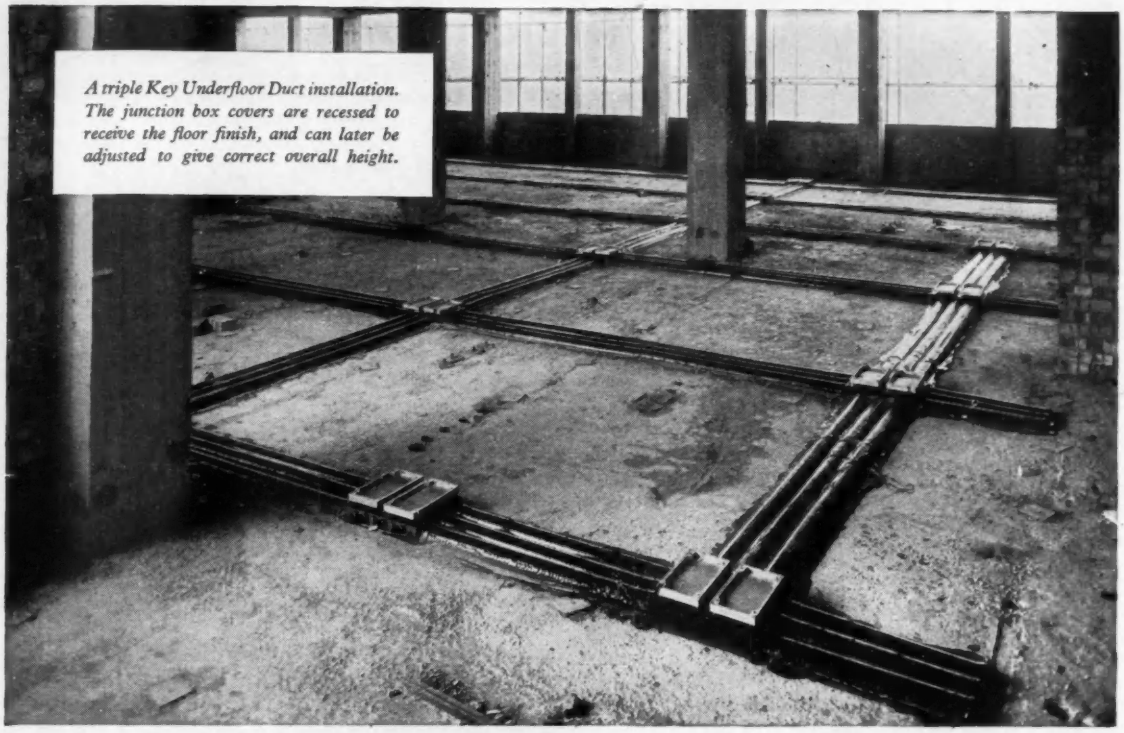

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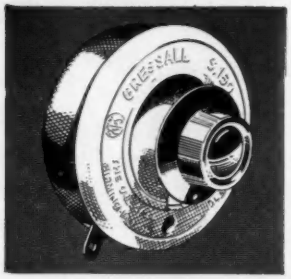

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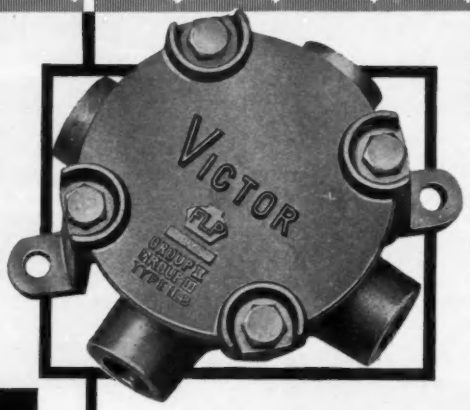

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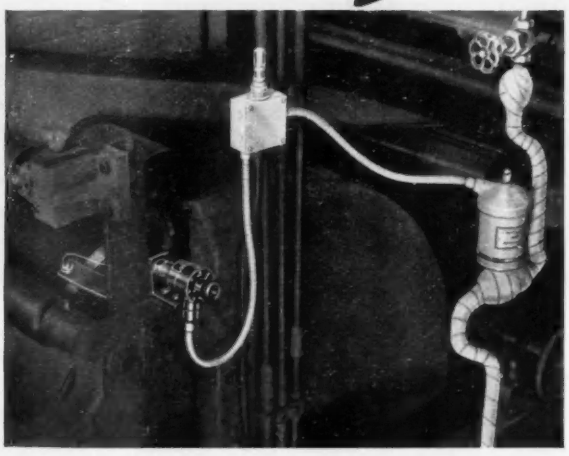
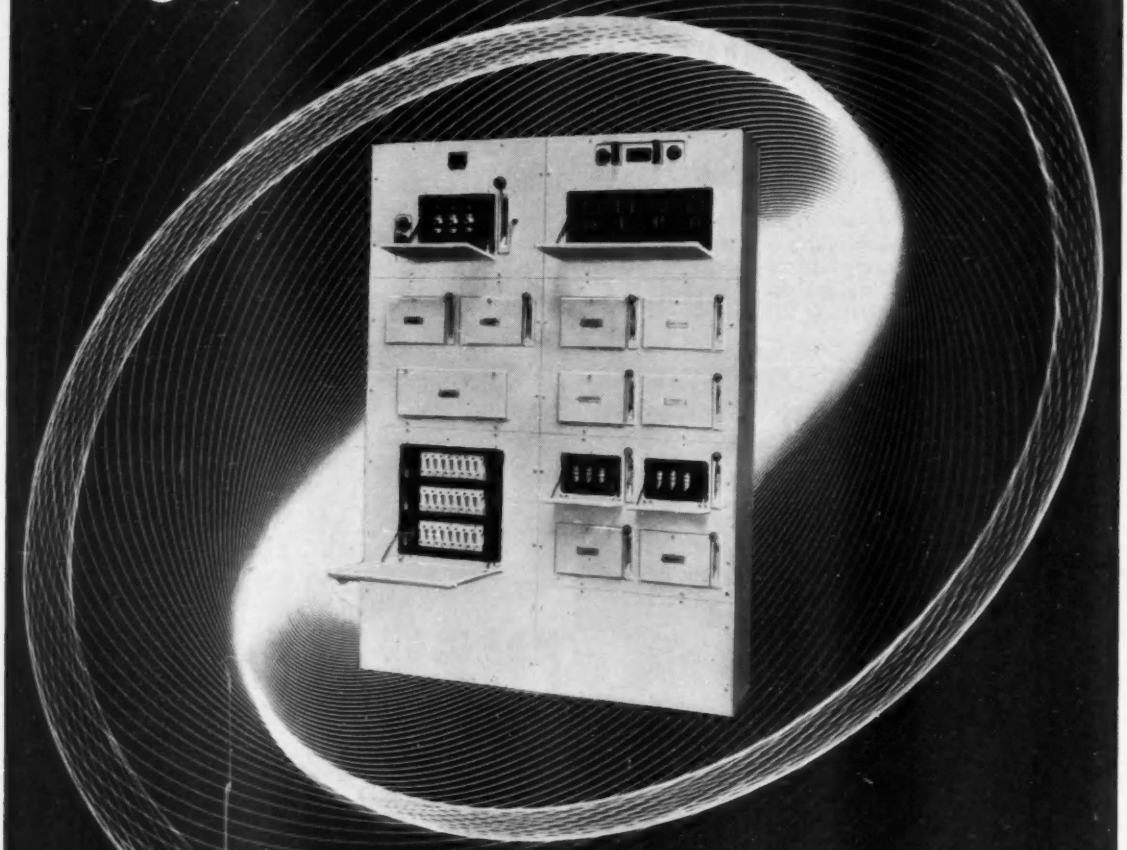


and suitable for application to awkward surfaces. Part of the Capillary Tube is embodied in the shoe which can be bent to fit the curvature of any size of drum, and which has a renewable hard copper surface. Control between 200°F. and 600°F. with a differential of ±5°F. These ranges can be altered to requirements within limits.

An illustration of a typical application of the BN.D Thermostat and Magnetic Valve controlling the surface temperature of a Steam Heated Revolving Drying Drum.

Robert Maclaren & Co. Ltd.
EGLINTON WORKS · KILBIRNIE ST. · GLASGOW, C.5
Telephone: SOUTH 2011/2/3. Telegrams: "SOCKET, GLASGOW"
We design and manufacture thermostats of all types

central power control



Ottermill Cubicle Type Switchboards are the most up-to-date form of centralised power control. Their superior appearance is the outward evidence of the excellent design, workmanship and materials which combine to provide first class performance. The Fuse Switches comply with the requirements of BS. 2510/1954 and BS. 861/1955 and have been ASTA type tested for 35 MVA making capacity.

OTTERMILL SWITCHGEAR LTD

SALES OFFICE: 1 VICTORIA STREET LONDON SW1

Telephone: ABBEY 5095/6 Telegrams: BUSBAR SOWEST

WORKS: OTTERY ST. MARY DEVON *TELEPHONE: OTTERY ST. MARY 264* *TELEGRAMS: BUSBAR OTTERY ST. MARY*

P.4670

make a note please . . .

to specify

WANDLESIDE CABLES

Our reputation in the cable industry has been built up over many years by making wires and cables of the highest quality. They are good and efficient and are to be found all over the world where reliability is of paramount importance.

If you are interested in the wire and cable business make a note to get in touch with us before you finalise your next specification.

For your information we manufacture :—

Aluminium Overhead Cables
" CORRUSTEEL " Armoured Cables
" WANDOVERPLAS " Overhead Cables
" FLORAWARM " Floor Heating Wires and Cables
" IRRAYDOL " Irradiated Cables
and a full range of all Domestic Wires and Cables

WANDLESIDE CABLES

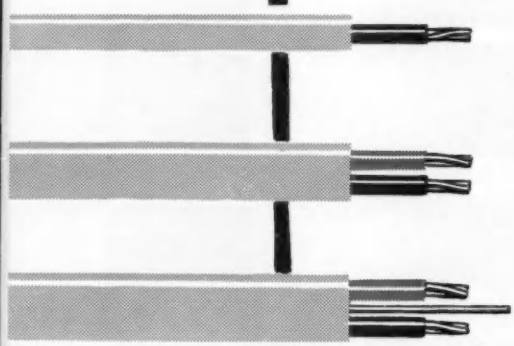
An independent company in the FALKS Group specialising in Wires and Cables

WANDLESIDE CABLE WORKS LTD. 106 GARRATT LANE WANDSWORTH LONDON SW18
Telephone : Battersea 2273 (5 lines) *Telegrams : Wandleside, London*

G*

POLYTHENE

INSULATED & P.V.C. SHEATHED CABLES



Single core, twin core and twin core and earth cables are now being supplied in a range to cover all normal wiring applications. The combined use of Polythene and P.V.C. provides resistance to oil, corrosion and flame propagation. These cables conform with BS. 1557.

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CERTIFICATION MARK

Founder Members of the C.M.A.

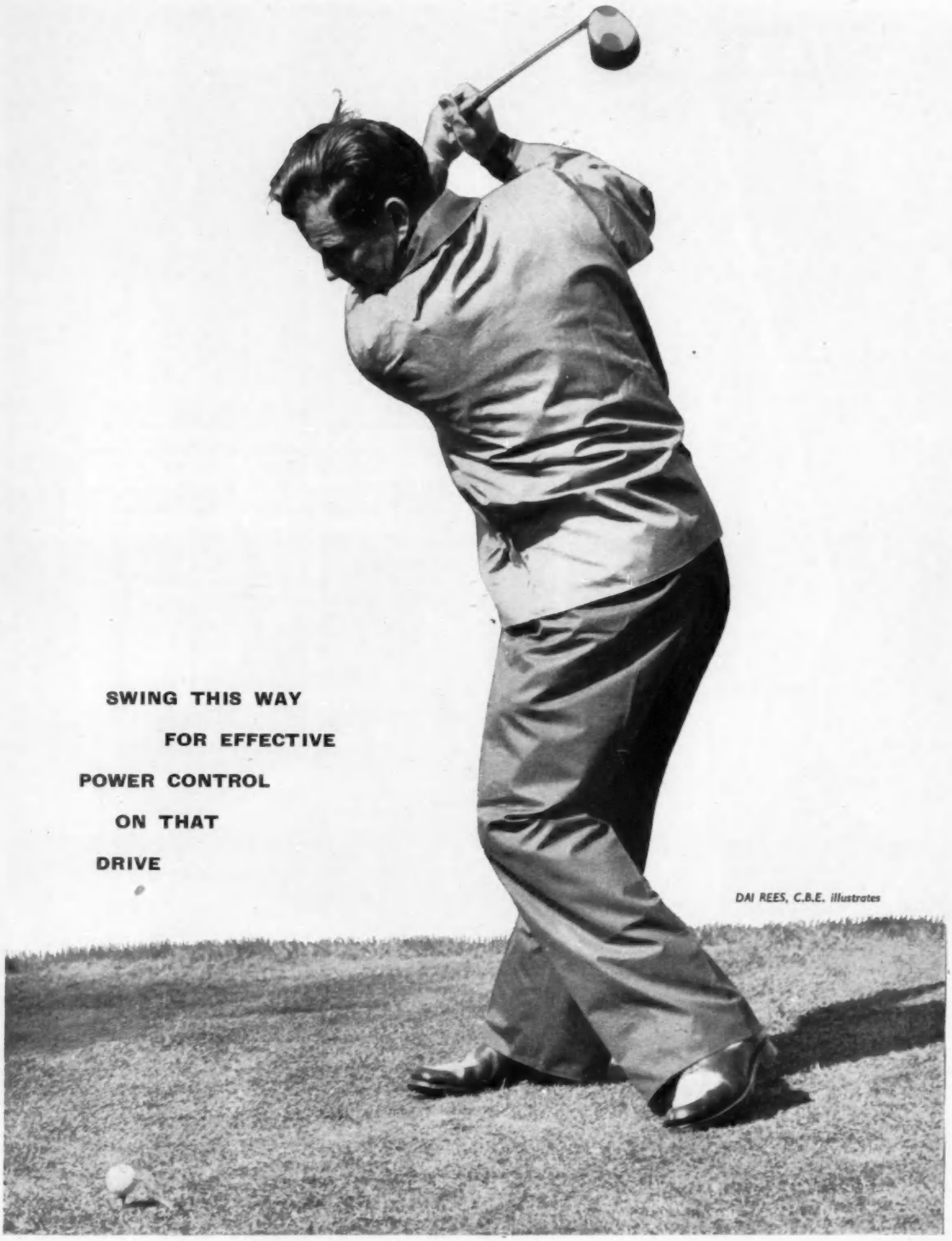
CONNOLLYS (BLACKLEY) LTD

HEAD OFFICE: MANCHESTER, 9. Phone: CHEetham Hill 1801. Grams: "Connollys, Blackley"

BRANCH SALES OFFICES AND STORES:

LONDON: 23 Starcross Street, N.W.1. Telephone: Euston 6122. Telephone: Victoria 4991/2. Telex 33-309. **BIRMINGHAM**: 39/44 Watery Lane, Bordesley, Birmingham 9. **GLASGOW**: 73 Robertson Street, C.2 Telephone: Central 3662

dm CL33

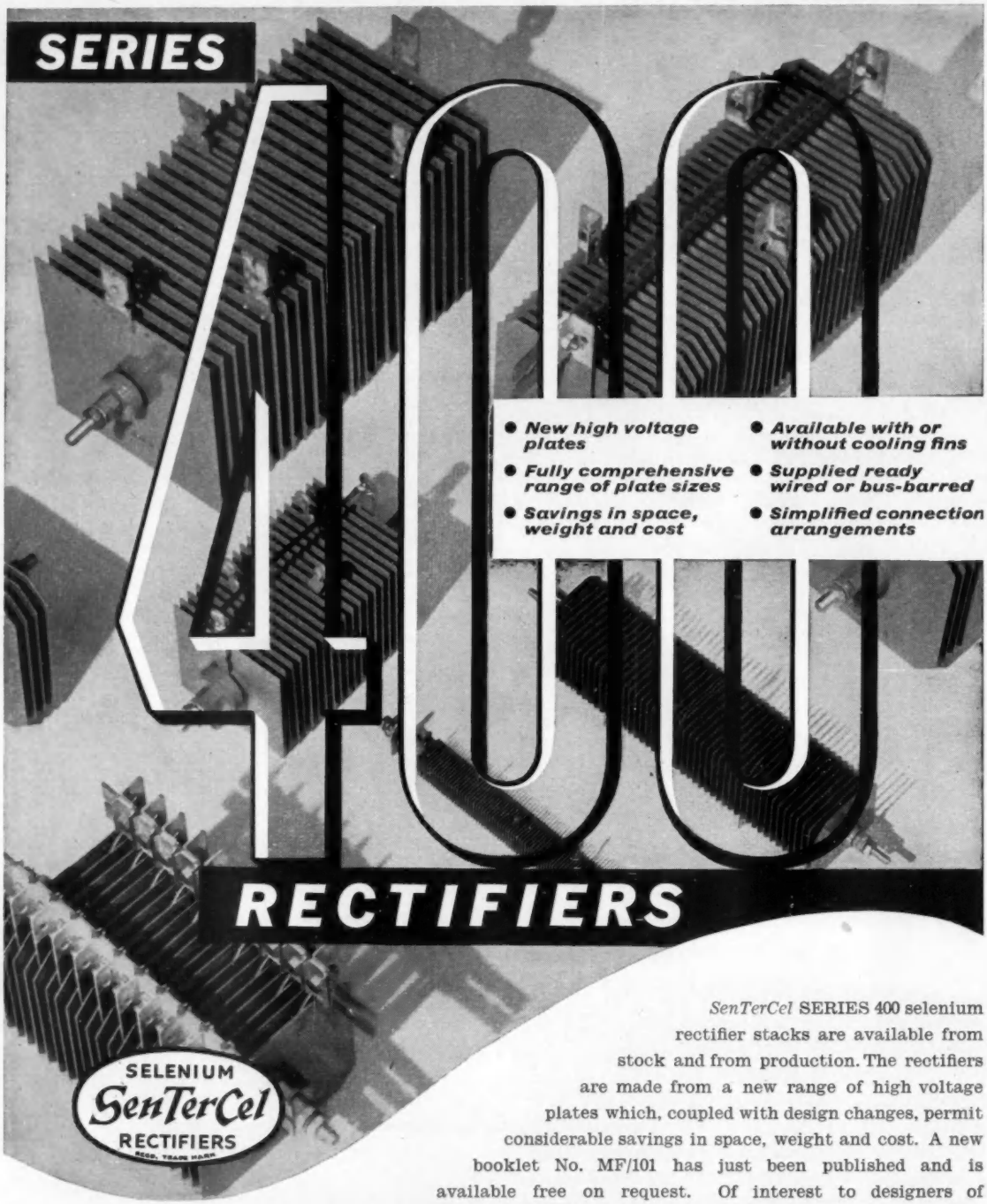


SWING THIS WAY
FOR EFFECTIVE
POWER CONTROL
ON THAT
DRIVE

DAI REES, C.B.E. illustrates

AIREDALE ELECTRICAL & MANUFACTURING CO. LTD.
Industrial Electric Motor Control Gear Makers
Head Office and Works: HARROGATE ROAD, APPERLEY BRIDGE, BRADFORD. Telephone: Idle 686
London Office: 225 GRAND BUILDINGS, TRAFALGAR SQUARE, W.C.2. Telephone: TRAfalgar 3559

POWER
DRIVE
CONTROL



- *New high voltage plates*
- *Fully comprehensive range of plate sizes*
- *Savings in space, weight and cost*
- *Available with or without cooling fins*
- *Supplied ready wired or bus-barred*
- *Simplified connection arrangements*

SenTerCel SERIES 400 selenium rectifier stacks are available from stock and from production. The rectifiers are made from a new range of high voltage plates which, coupled with design changes, permit considerable savings in space, weight and cost. A new booklet No. MF/101 has just been published and is available free on request. Of interest to designers of conversion equipment, this publication gives full electrical and mechanical information concerning SERIES 400.

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, London, W.C.2

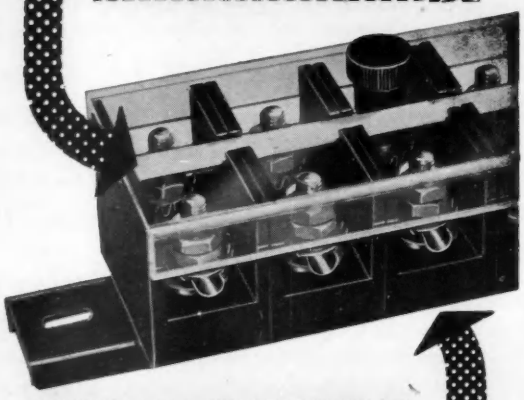
RECTIFIER DIVISION: EDINBURGH WAY · HARLOW · ESSEX

A NEW IMPROVED TERMINAL BLOCK BY ATL

DEVELOPED FROM OUR WELL-KNOWN STANDARD MODEL

INCORPORATING IDENTIFICATION LABEL

SUPPLIED PLAIN OR ENGRAVED TO ORDER
DOVETAILED FIRMLY INTO THE BODY
CAN BE SLID OUT WHEN REQUIRED



SPECIFICATION

MOULDED BODY AND SIDE SHIELDS, FITTED WITH O.B.A. BRASS STUDS, LINKS AND ROSS-COURTNEY TYPE TERMINALS AND NUTS. NON-INFLAMMABLE PLASTIC TRANSPARENT COVER AS AN OPTIONAL EXTRA. SUPPLIED AS SINGLE, ONE-WAY UNIT, OR AS BUILT-UP BLOCKS.

AUSTIN TAYLOR ELECTRICAL LTD.

THORLEY STREET FAILSWORTH

MANCHESTER TEL: FAIlsworth 3246/7

CW 3307

R·E·A·L 'CLIPTITE' CEILING FITTINGS

Compact and completely dustproof!

Designed on contemporary lines, the "Cliptite" Fitting No. 1223 will blend happily with any scheme of interior furnishing in modern style. Accommodating a 100 watt. size lamp, the unit incorporates the famous "Cliptite" patented method of fixing which renders the inside of the bowl absolutely dustproof! Send NOW for illustrated folder.

REAL

R.E.A.L. *is the registered trade mark of*

ROWLANDS ELECTRICAL ACCESSORIES LTD.,
R.E.A.L. WORKS, BIRMINGHAM, 18

ANY OLD IRON

won't do for her . . .

she wants a Revo Automatic Electric Iron

Here's the answer to housewives who think their old iron "good enough". Captivating "House & Garden Colours" arrest the eye at once. Closer examination reveals a superb easy-grip jet black moulded handle (with left or right thumb-rest) . . . a large finger-tip control knob with graduated settings for appropriate fabrics . . . and a streamlined chromium sole plate for effortless ironing.

* * *

★ *Available in Chromium plate or colours in Porcelain or Art enamel—Citron Yellow, Dresden Blue, Willow Green, Guardsman Red.*

★ *Remarkably quick-heating — stays hot longer, too!*

Weight 4½ lbs. For A.C. Mains only. Loading 650 watts. Complete with non-kink flexible cable. Prices: Chromium Plated 45/- plus 9/11 P.T. Colours in Porcelain Enamel 47/6 plus 10/5 P.T. Colours in Art Enamel 39/6 plus 8/7 P.T.

Electric Fans

The Mayfair Plate Warmer

Revo Robot

Electric Kettles

Electric Fires

Convector Heaters

Revo Cookers

Choose right - choose **REVO** REGD. ***Automatic Electric Iron***

Write for details of any of the above appliances to:

REVO ELECTRIC CO. LTD., TIPTON, STAFFS. 'PHONE: TIPTON 2828 GRAMS: REVO TIPTON

Have YOU the new answer to increased productivity on your file?

For nearly 80 years Coles have led the field in mobile crane design . . . now we go still further ahead. Foreseeing your need for greater productivity, we have improved on the best to give you the crane of tomorrow today.
Coles new range comprises 15 models, each one an outstanding Diesel-Electric Transmission unit revolutionary in design and earning power.

COLES

THE NAME THAT CARRIES WEIGHT

Designed, Manufactured and marketed by:
STEELS ENGINEERING PRODUCTS LIMITED
Sunderland, England. Tel: 56281 (10 lines) Grams: Steel, Sunderland

SALES & SERVICE: Glasgow: 235 Bath St., C.2. Newcastle: Worswick Chambers, Worswick St., 1. London: 143 Sloane St., S.W.1 Manchester: 153 Oxford Rd., 13. Birmingham: 39 Thorp St., 5

Comprehensive literature is now available — bring your file up-to-date.

2 YEARS' PROGRESS

in industrial mechanization

A special issue of the journal organizing the

MECHANICAL HANDLING EXHIBITION

The biennial Mechanical Handling Exhibition, opening on 7 May, will reflect the tremendous advances made in labour-aiding devices. Previewing this important event, the heavily enlarged May issue of MECHANICAL HANDLING provides a fully-illustrated, stand-by-stand guide to the whole exhibition. Enter a subscription to MECHANICAL HANDLING now, for a year-round supply of essential news and information on industrial mechanization — starting with the May "Preview" number.

Place your subscription now to secure

THE MUCH ENLARGED MAY SHOW NUMBER

TO **MECHANICAL HANDLING**

DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1

Please enter my subscription to MECHANICAL HANDLING for the next 12 months (12 issues), starting with the May Exhibition Preview Number. I enclose remittance for £2. 17. 0d. (U.S.A. and Canada $8.00).

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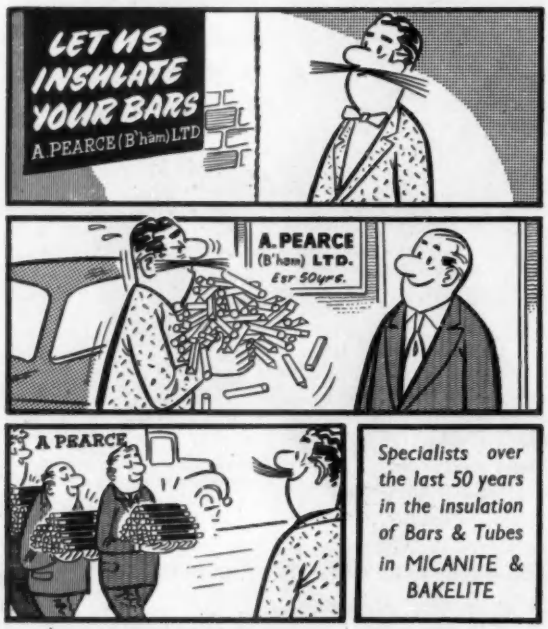

Specialists over the last 50 years in the Insulation of Bars & Tubes in MICANITE & BAKELITE

A. PEARCE (BIRMINGHAM) **LTD.**

MORCOM ROAD WORKS • GREET

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ON ADMIRALTY LIST *PHONE : ACOCKS GREEN 0102*

FDS REGD

THIS IS THE MARK

known everywhere in the trade for the best

INSULATED WIRES AND STRIPS

F. D. SIMS LIMITED

P.O. BOX 8, Hazelhurst Works

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Telephone: Ramsbottom 2213/4/5

Telegrams: "SIMS" Ramsbottom

London Office and Stores:

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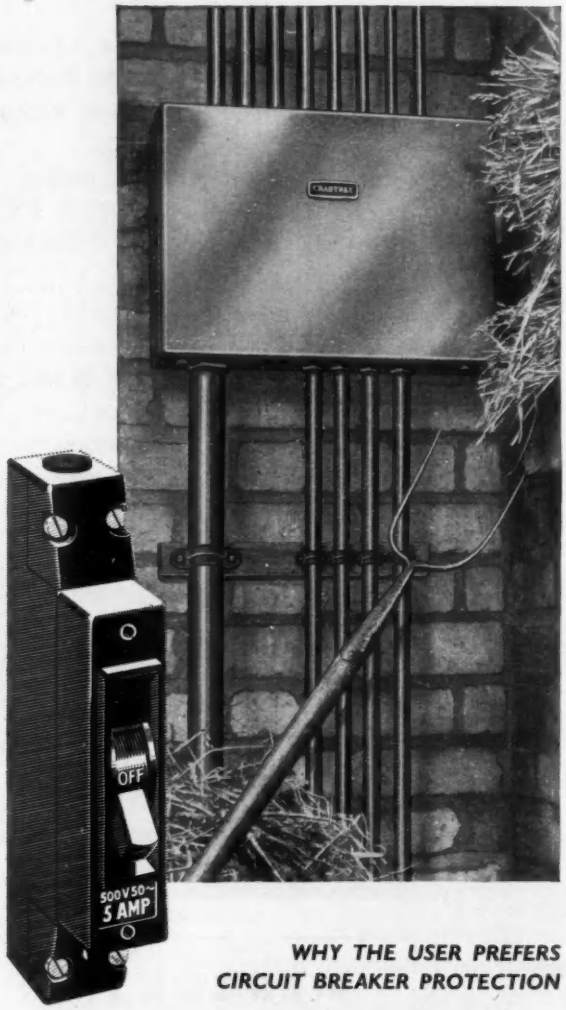
S44

CRABTREE MINIATURE CIRCUIT BREAKERS



UNFAILING OPERATION IN ALL CONDITIONS

The Crabtree Type F-60 miniature circuit breaker gives reliable service, even under the most exacting conditions. Positive drive enables the unit to be closed and opened in all circumstances, whilst the trip-free handle prevents the breaker being held closed under fault conditions. The distribution board cases are provided with adequate dustproofing facilities. Other features of this interesting new range are given in Publication No. 1191, available on request.

WHY THE USER PREFERS CIRCUIT BREAKER PROTECTION

"Minor electrical faults no longer upset our production flow."

CRABTREE TYPE F 60

A CIRCUIT BREAKER OF UNEQUALLED PERFORMANCE

J. A. Crabtree & Co. Ltd., Lincoln Works, Walsall, Staffs.

C.772

The CLIPPON UNIVERSAL HANDLAMP

CMC

FOR MOTOR REPAIR WORK, MACHINE SHOPS, ETC. A NECESSARY ACCESSORY FOR ALL TRADES

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C. M. CHURCHOUSE LTD.

CLARENDON CROSS, LONDON, W.11

Telephone: PARk 5666/7/8

resistance wire and tape

of highest grade in

NICKEL CHROMIUM
NICKEL CHROMIUM IRON
COPPER NICKEL

also

PURE NICKEL
STAINLESS STEEL
AND TITANIUM WIRE

AW

ALLOY WIRE CO. LTD.
Lawrence Lane · Old Hill
Staffordshire
Telephone: Cradley Heath 66775

If it's SOLDERING you *must* have

A model for every purpose

HENLEY SOLON
ELECTRIC SOLDERING IRONS

for 25 years the best

Leaflets on request from:

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.
61-53 Hatton Garden, London E.C.1
Tel: CHAncery 6822

65 watt oval tapered bit

PORCELAINS
for the Electrical and Allied Trades

GASKELL & GROCOTT LTD.
Whitehall Works, Porthill, Staffs
Telephone: Stoke-on-Trent 84611-3

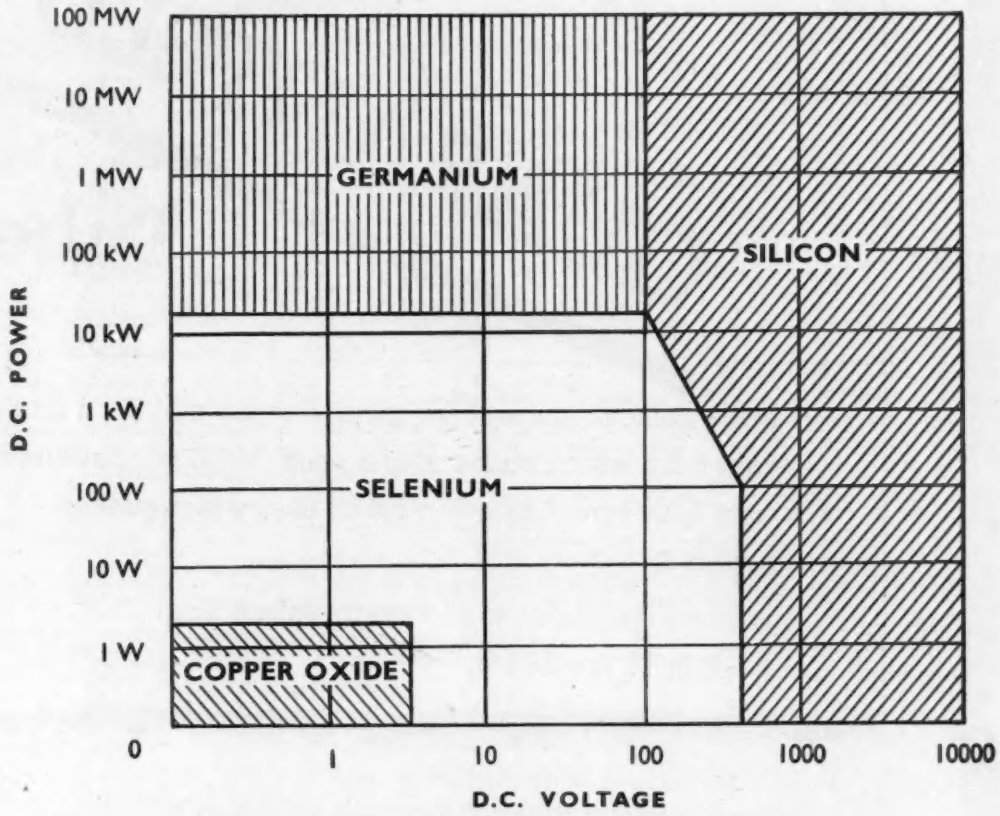
MERCURY SWITCHES

will solve your switching problems
We offer completely reliable switches
coupled with good delivery

Write for catalogue

QUICKSILVER TUBE MFG. COMPANY
Willow Road, Poyle Estate, Colnbrook, Bucks.
Tel.: Colnbrook 2382

Which rectifier shall I use?



WESTINGHOUSE

makes them all

Westinghouse Brake and Signal Co. Ltd., 82 York Way, King's Cross, London, N.1 Phone : TERminus 6432

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Osram the GUARANTEED Tube

A free replacement will be given for any standard straight Osram tube which fails under normal service conditions before 3,000 hours or one year of use, whichever is the shorter.

This guarantee covers all Osram Tubes from 1½ ft – 8 ft, 15 w – 125 w.

Unique manufacturing processes are used in making Osram guaranteed tubes. These techniques are designed to eliminate early failures and ensure superb maintenance of lighting efficiency throughout a long life.

Osram Guaranteed Tubes for trouble-free lighting

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%: 26, 10%: 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue and should be addressed to ELECTRICAL REVIEW, Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

AIREBOROUGH URBAN DISTRICT COUNCIL

Installation of Class "B" Street Lighting in Hawksworth Lane, Queensway, and Nunroyd Avenue, Guiseley

TENDERS are invited for the supply and installation of Class "B" Mercury Vapour Street Lighting in Hawksworth Lane, Queensway, and Nunroyd Avenue, Guiseley. Approximate number of points, 52.

Separate tenders are invited as follows:—

(1) Supply and erection of columns and brackets and fitting and wiring of lanterns to columns, etc.

(2) Supply of lanterns and all auxiliary gear.

A firm may tender for both, but the Council reserve the right to accept separate tenders from different firms.

Copies of the plan, instructions to persons tendering, specifications, bills of quantities, forms of tender and schedule of rates and prices may be obtained from, and general conditions of contract seen at, the office of the Engineer and Surveyor to the Council at the address below, on payment of a deposit of two guineas, which will be returned on receipt of a bona fide tender or the return of the documents.

Tenders, enclosed in a plain sealed envelope, endorsed "Tender for Street Lighting," must be delivered to the undersigned not later than mid-day on Wednesday, 28th May, 1958.

The Council does not bind itself to accept the lowest or any tender, and the acceptance of a tender or tenders will be subject to the obtaining by the Council of any requisite consents.

RALPH H. HULME,
Clerk to the Council.

Council Offices,
Micklefield House,
Rawdon, Leeds.
25th April, 1958. 3259

BOROUGH OF ELLESMERE PORT

Contract No. 240

Illumination of Speed Restriction Signs

TENDERS are invited for the illumination of 8 Speed Restriction Signs in the Borough consisting of providing and fixing new speed restriction signs, lighting fittings, strap-on boxes housing the control gear, and the repainting of the existing steel poles.

The conditions of contract and location plan may be seen by appointment, and a set of contract documents comprising specification, bills of quantities and form of tender may be obtained at the offices of the Borough Engineer and Surveyor's Sub-Office, Queen Street, Ellesmere Port, on payment of a deposit of one guinea, which deposit will be refunded on the return of the contract documents, or, in the case of a bona fide tender which is accepted and not subsequently withdrawn, on completion of the formal contract between the Council and the successful tenderer.

Sealed tenders in the plain official envelope provided must reach the undersigned by post by not later than 5 p.m. on Friday, 20th June, 1958. Tenders received after this date and time will not be considered by the Council, and they do not bind themselves to accept the lowest or any tender.

R. J. BERNIE,
Town Clerk.

Municipal Offices,
Ellesmere Port.
24th April, 1958. 3257

COUNTY BOROUGH OF GATESHEAD

Hill Head Secondary Modern School for 450 Girls

APPLICATIONS are invited from Contractors desirous of tendering for the ELECTRICAL INSTALLATION at the above School in accordance with the scheme and specification prepared by Messrs. R. W. Gregory & Partners.

Intending Contractors should give evidence of having recently carried out contracts of similar size.

Copies of drawings, specification and form of tender may be obtained from, and the general conditions of contract inspected at, the Borough Surveyor's Office upon deposit of £2 2s., which will be refunded on receipt of a bona fide tender and the return of the drawings and specification.

The Contract for the above work will form a Sub-Contract to the Main Building Contract and the Sub-Contractor will be required to enter into a Bond with the General Contractor.

The Contract will not include any clause to cover adjustments for fluctuations in Contractor's costs.

Applications to tender should be made in writing to G. F. Winters, Esq., B.E., A.M.I.C.E., Borough Surveyor, Municipal Buildings, Swinburne Street, Gateshead, 8, not later than noon on Wednesday, 7th May, 1958, and tenders sent to the undersigned on the official form, sealed in the endorsed envelope supplied, not later than noon on Wednesday, 11th June, 1958.

The lowest or any tender will not necessarily be accepted.

C. D. JACKSON,
Town Clerk.

Town Hall,
Gateshead, 8. 3276

COUNTY COUNCIL OF ESSEX

Chelmsford King Edward VI Grammar School

Renewal of Electrical Installation

THE Education Committee of the County Council of Essex invites contractors who are willing to tender for the above contract to submit their names.

The work consists of the removal of the electrical installation, using as much existing material as possible, and the estimated value is £2,970.

The buildings will remain in occupation and the contract includes incidental builders' work.

From the names submitted a panel of contractors will be chosen, who will subsequently be provided with specifications.

Contractors' applications should be sent to reach the undersigned not later than Saturday, 10th May, 1958.

H. CONOLLY, C.B.E., F.R.I.B.A.,
County Architect.

County Hall, Chelmsford.
May, 1958. 3301

METROPOLITAN BOROUGH OF WANDSWORTH

Traction Batteries

TENDERS invited for supply of eight Traction Batteries for pedestrian-controlled Electric Trucks.

Tender documents, obtainable from the Borough Engineer, must reach me by 10 a.m., 21st May, 1958.

R. H. JERMAN,
Town Clerk.

Municipal Buildings,
London, S.W.18. 3283

URBAN DISTRICT COUNCIL OF HAVANT AND WATERLOO

propose to relight Bedhampton Way and parts of Hulbert Road, Park Road South, Dunsbury Way and Stockheath Road within the Urban District with a total of 87 140-watt Sodium Discharge Lamps.

Fixed price tenders are invited for (a) Supply, including delivery to site, of totally enclosed lanterns, lamps, auto-transformers, capacitors, time switches and fuses; (b) Provision and erection of drawn tubular steel columns and wiring, fixing and bringing into service lanterns and equipment supplied by the erection contractor under (a) above; (c) Provision and erection of drawn tubular steel columns, and wiring, fixing and bringing into service lanterns and equipment delivered to the site by a supplier selected by the Council.

Conditions of contract and site drawings may be inspected at the office of the Engineer and Surveyor, 1, Park Road North, Havant, from whom the specification, bill of quantities and form of tender may be obtained.

No tender will be received except in a plain sealed envelope, which may bear the word "Tender" followed by the subject to which it relates, but shall not bear any name or mark indicating the sender.

Tenders must be delivered not later than Wednesday, 14th May, 1958, to the Clerk of the Council, Town Hall, Havant.

The Council do not bind themselves to accept the lowest or any tender. 3299

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Aberdeenshire Transmission Development

TENDERS are invited for the construction of a 132-kV double circuit Steel Tower Overhead Transmission Line between Craigiebuckler and Redmoss, near Aberdeen.

Tender documents may be obtained on application with a cheque for £2 2s. (returnable) to Messrs. Merz & McLellan, 72a, George Street, Edinburgh, 2.

The Board do not bind themselves to accept the lowest or any tender. 3300

CITY OF MANCHESTER

Davyhulme Sewage Works Extensions

TENDERS invited for the Electrical Installation of Lighting, Heating and Clocks in the Main Pumping Station and the Power Station.

Tender documents obtainable from City Surveyor, Town Hall, Manchester, 2, on payment of deposit of £4 4s. (returnable on receipt of bona fide tender).

Tenders to be returned by 19th May, 1958. 3258

SITUATIONS VACANT

ELECTRICAL DESIGNER

required for progressive position in London drawing office of Molins Machine Co. Ltd., inventors and manufacturers of automatic machinery.

Applicants should be aged 25-40, with technical qualification at least up to H.N.C. level, and with broad background of experience in the design of electrical and electro-mechanical equipment as applied to precision machinery.

Write in confidence — Personnel Manager, Evelyn Street, London, S.E.8. 3165

Situations Vacant *(continued)*

CORPORATION OF WILLESDEN

Electrical Engineering Assistant

APPLICATIONS are invited for the following appointment: ELECTRICAL ENGINEERING ASSISTANT, Special Grade (£750-£1,030 p.a.).

London weighting, maximum £30 p.a., is payable in addition to the above salary.

Candidates should possess appropriate qualifications and should have experience in the design of electrical equipment and installation.

The Council cannot assist with housing.

Full details and form of application may be obtained from the Borough Engineer and Surveyor, Town Hall, Dyne Rd., Kilburn, London, N.W.6, and must be returned to the undersigned not later than 9 a.m. on Monday, 19th May, 1958.

R. S. FORSTER,
Town Clerk.

18th April, 1958. 3242

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following appointments in this Division :—

DEPUTY STATION SUPERINTENDENT, CASTLE DONINGTON POWER STATION (Vacancy No. 73/58/ER).

Applicants should preferably be Corporate Members of the Institution of Mechanical and/or Electrical Engineers and have had experience in a responsible position in a power station equipped with high pressure plant including pulverised fuel boilers.

Salary will be in accordance with Class L, Grade 3 (£1,685-£1,790 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 5th May, 1958.

SHIFT CONTROL ENGINEER, DRAKELOW POWER STATION (Vacancy No. 63/58/ER).

Applicants should have had a good general education and technical training with practical experience in the control and operation of large modern switchgear. Preference will be given to candidates who possess technical qualifications to Higher National standard.

The salary will be in accordance with Class J, Grade 10 (£885-£930 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 7th May, 1958.

THIRD ASSISTANT ENGINEER, GENERATION (Operation) DEPT., OPERATIONAL RESEARCH SECTION, DIVISIONAL HEADQUARTERS (Vacancy No. 64/58/ER).

Applicants should be fully qualified electrical or mechanical engineers, and previous experience of operational research is desirable, but not essential, as there will be opportunities for training in the technique.

Salary will be in accordance with Class AX/EX, Grade 6 (£895-£1,140 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 7th May, 1958.

PLANT SHIFT CONTROL ENGINEERS, CASTLE DONINGTON POWER STATION (Vacancy No. 65/58/ER).

Experience desirable in control of boilers and turbines at high pressure and temperature, pulverised fuel, together with electrical control room experience.

Technical qualifications to Higher National Certificate desirable.

Salary will be in accordance with Class L, Grade 10 (£995-£1,055 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 7th May, 1958.

FOURTH ASSISTANT ENGINEER, DRAKELOW TRANSMISSION SECTION (Vacancy No. 68/58/ER).

Applicants should have experience of the maintenance and operation of E.H.T. overhead lines, transformer and switchgear.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/EX, Grade 8 (£710-£935 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 7th May, 1958.

SECOND ASSISTANT CHEMIST, WILLINGTON "A" POWER STATION (Vacancy No. 70/58/ER).

Candidates should have had previous experience in a power station laboratory and should hold the Higher National Certificate in Chemistry. They should be familiar with the methods of sampling and analysis of coal, water and oil and with the interpretation and application to power station practice of the analytical results.

Salary will be in accordance with Class K, Grade 11 (£885-£930 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 7th May, 1958.

SENIOR ASSISTANT ENGINEER (Resident), CASTLE DONINGTON POWER STATION (Vacancy No. 66/58/ER).

The duties for the above position include general supervision of the erection and commissioning of all mechanical and electrical plant; for example, turbo-alternators, and condensing plant, feed heating equipment, boilers, pumps, high-pressure steam and feed piping, switchgear, transformers, and cables, coal and ash handling plant and ancillary equipment. Corporate Membership of the Institution of Mechanical Engineers or the Institution of Electrical Engineers would be a recommendation.

Candidates should be experienced in the supervision of such power station equipment and in co-ordinating work on site in close collaboration with the Resident Engineer responsible for civil engineering and building works and with Divisional Headquarters' staff.

Salary will be in accordance with Class AX/EX, Grade 3 (£1,330-£1,595 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 7th May, 1958.

SENIOR ASSISTANT ENGINEER (Resident), SPONDON "H" POWER STATION (Vacancy No. 67/58/ER).

The duties for the above position include general supervision of the erection and commissioning of all mechanical and electrical plant; for example, turbo-alternators, and condensing plant, feed heating equipment, boilers, pumps, high-pressure steam and feed piping, switchgear, transformers, and cables, coal and ash handling plant and ancillary equipment. Corporate Membership of the Institution of Mechanical Engineers or the Institution of Electrical Engineers would be a recommendation.

Candidates should be experienced in the supervision of such power station equipment and in co-ordinating work on site in close collaboration with the Resident Engineer responsible for civil engineering and building works and with Divisional Headquarters' staff.

Salary will be in accordance with Class AX/EX, Grade 3 (£1,330-£1,595 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 7th May, 1958.

GENERAL ASSISTANT ENGINEER (Planning Office), CASTLE DONINGTON POWER STATION (Vacancy No. 40/58/ER).

Applicants should have had wide practical experience of power station maintenance, and be capable of planning and progressing work, compiling records and reports and controlling plant spares.

Salary will be within Class L, Grades 17/15 (£635-£785 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 7th May, 1958.

These appointments will be pensionable under the terms of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. PLEASE QUOTE VACANCY NUMBER.

L. F. JEFFREY,
Divisional Controller.

23rd April, 1958. 3262

CITY OF SALISBURY, SOUTHERN RHODESIA

Vacancies in the Electricity Department

APPLICATIONS are invited for posts (a), (b) and (c) in the Generation Section and post (d) in the Distribution Section of the Salisbury, Southern Rhodesia, Municipal Electricity Department.

Salary for posts (a) and (d):
£2,300 × £100 to £2,600.

Salary for post (b):
£2,025 × £75 to £2,250.

Salary for post (c):
£1,725 × £50 to £1,875.

The successful candidate for post (a) will be responsible under the City Electrical Engineer and his Assistant for the whole of the Generation Section of the Undertaking.

Details of the City's power stations, comprising 153 MWs of plant, along with brief particulars of the Pension and Widows' and Orphans' Fund, leave, housing, etc., can be obtained from the undersigned on application.

Candidates, who must be chartered engineers, must have had considerable experience in the operation of power stations with modern pulverised fuel boilers.

The income tax on £2,300 at present rates for a married man with one child would be approximately £156, and on £2,600 would be approximately £230.

The successful candidate for post (b) will be the immediate Assistant to the engineer appointed under post (a).

The income tax on £2,025 at present rates would be approximately £112 for a married man with one child.

The successful candidate under post (c) will be responsible to the Power Station Superintendents and to the above officials for the preparation, accuracy and correlation of all technical data required for the efficient control of the generating plant installed in the Salisbury power stations.

He will also be responsible for the thermal or mechanical testing of plant in accordance with British standards, or standard practice.

The position calls for a knowledge of the theory of electrical, fluid and temperature measurement techniques as applied to thermal power station plant testing procedure, and practical experience in the operation of electrical generating plant is essential.

The income tax on £1,725 for a married man with one child would be approximately £80 per annum, and on £1,875 approximately £86 per annum.

Applications are also invited for post (d), the successful candidate for which will be responsible under the City Electrical Engineer and his Assistant for the whole of the Distribution Section of the Undertaking.

Details of the City's Distribution Department, along with brief particulars of the Pension and Widows' and Orphans' Fund, leave, housing, etc., can be obtained from the undersigned on application.

Candidates must state whether they are applying for post (a), post (b), post (c) or post (d) or a combination of any, and must be Associate Members of either the British Institution of Mechanical Engineers or the British Institution of Electrical Engineers.

The successful applicant will be required to submit a satisfactory medical certificate and serve a probationary period of six months, and if thereafter confirmed in his appointment, to join the Southern Rhodesia Local Authorities' Joint Pension and Widows' and Orphans' Fund. Candidates are requested to submit full particulars of their qualifications, training and experience, which should include details of positions held and salaries received. Particulars of age, place of birth, nationality and marital state should also be given, and copies of not more than three recent testimonials may be included.

Applications, on air mail paper, should be addressed to the undersigned, and arrive not later than the 16th May, 1958.

DAVIS & SOPER LTD.

54, St. Mary Axe,
London, E.C.3. 3176

CLASSIFIED ADVERTISEMENTS ARE PREPAID

BRITISH INSULATED CALLENDER'S CONSTRUCTION CO. LTD.

have vacancies in their Overhead Line Contracts Department in London for :—

ASSISTANT DESIGN ENGINEERS. Work involves structural design aspects of electrical transmission and distribution lines. Previous experience desirable, although not essential, but structural background up to H.N.C. standard an advantage. After appropriate training successful applicant will be expected to conduct technical correspondence and negotiations. The posts carry progressive responsibility.

Attractive salaries will be offered to suitable applicants. Pension fund, staff canteen, 5-day week.

Apply in writing stating age to Personnel Officer (Staff), above company, at 30, Leicester Square, London, W.C.2, quoting reference C/90/55. 3244

BAHAMAS ELECTRICITY CORPORATION

APPLICATIONS are invited for the appointment of SENIOR RESIDENT ENGINEER to supervise the construction of a new Power Station at Clifton Pier, New Providence Island, in the Colony of the Bahamas. The work should be of considerable interest to an experienced engineer, since the initial project consists of two 100,000 lb./hr. oil fired boilers, one back pressure and one pass-out turbine each capable of an electrical output of 6,100 kW and steam output of 71,000 lb./hr. at 12 p.s.i.a., two sea water exaporating plants each with an output of 500,000 gallons of distillate per day, high tension and low tension switchgear, pipework, pumps, etc.

The Senior Resident Engineer will be in overall charge of the work but there will also be on the site a Civil Resident Engineer and later an Assistant Mechanical and Electrical Resident Engineer.

Applicants must not be less than 40 years of age and must be Corporate Members of either the Institution of Mechanical Engineers or the Institution of Electrical Engineers. They must also have had substantial experience of steam power plant construction and operation. It would also be of some advantage if the engineer has had experience of large scale evaporating plant.

The appointment will carry a salary of £3,000 per annum and will be on contract for a period of two years, with the possibility of extension by mutual agreement. Free quarters will be provided or, if not available, a housing allowance in lieu. Leave will be granted on the expiry of the contract at the rate of four weeks for each year of service. First-class passages between the Bahamas and the United Kingdom will be provided for the engineer and his wife and family, if any, under sixteen years of age. There is at present no income tax in the Bahamas.

Applications giving full details of age, qualifications, previous experience and references should be addressed to Preece, Cardew & Rider, 8, 10 & 12, Queen Anne's Gate, Westminster, London, S.W.1, and should reach their office within 14 days of the date of this advertisement.

3307

ASSISTANT CHIEF ELECTRICAL DESIGNER

OPPORTUNITY in Glasgow for a young man with experience in A.C. motor design to assist chief electrical engineer on development of A.C. rotating machinery and factory installation.

Applicants should state technical qualifications, age, and previous experience. Canteen and sports facilities, good pension scheme coupled with free life assurance.—Box 3309.

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or B. Salary includes London allowance. Qualifications entitling to Graduate Membership of I.E.E. or I.Mech.E. for posts (a) and Corporate Membership for post (b) an advantage.

(b) MAINTENANCE ENGINEER (Electrical), DEPTFORD EAST POWER STATION (Vacancy No. 58/289).

Sound technical training with experience in modern power station electrical plant maintenance, also character and ability to supervise staff. Salary Class J, Grade 7 = £1,115 p.a.

(a) ASSISTANT ENGINEERS (R. & M.), FULHAM POWER STATION (Vacancy No. 58/290).

Applicants should have had sound technical training and have had experience of power station operation or maintenance. Salary Class K, Grade 15 = £725 p.a.

(a) ASSISTANT TO APPRENTICES TRAINING OFFICER, BANKSIDE TRAINING SCHOOL SOUTHWARK, S.E.1 (Vacancy No. 58/291).

Due to promotion the above vacancy has occurred. Applicants should have sound practical and technical training in mechanical engineering with workshop experience in blacksmithing and welding. They will be required to carry out instruction in the basic mechanical engineering skills to enable the apprentices to acquire the elements of blacksmith's and welder's techniques. Ability to assist with machine tool demonstration an added advantage. Salary Class AX/EX, Grade 8 = £750 to £985 p.a.

(a) ASSISTANT CHEMIST, DIVISIONAL LABORATORY, BATTERSEA POWER STATION (Vacancy No. 58/292).

Duties are varied and essentially practical, including non-routine analysis, plant trials and development of methods and instruments. Experience of power industry not essential, but candidates must be qualified chemists. Salary Class AX/EX, Grade 7 or 8 = £860/£1,085 or £750/£985 p.a.

Applications, quoting vacancy number, to (or on form from) Central Electricity Generating Board, London Division, P.O. Box 136, London, W.1, by 12th May, 1958. 3261

YORKSHIRE ELECTRICITY BOARD

No. 3 (Sheffield) Sub-Area

SENIOR DRAUGHTSMAN (Electrical). Applicants should have had a good general and technical education to at least O.N.C. standard, with experience in the electrical layout of substations and the preparation of diagrams for electrical equipment.

Salary N.J.B. Schedule D, Grade 5, £760/£860 per annum.

SENIOR DRAUGHTSMAN (Civil and Building). Applicants should have a good general and technical education to at least O.N.C. standard, with drawing office experience in the work associated with the design and construction of substation, office and other buildings.

Salary N.J.B. Schedule D, Grade 5, £760/£860 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, not later than 16th May, 1958. 3308

SOUTH WALES SWITCHGEAR LIMITED

Blackwood, Mon.

have vacancies for DRAUGHTSMEN in the High Voltage Switchgear Contract and Diagram Sections of their Drawing Office.

Applications giving full particulars of experience, age and qualifications to the Personnel Manager.

3267

PIRELLI-GENERAL CABLE WORKS LTD.

invite applications for the position of

TECHNICAL ASSISTANT TO THE MANAGER OF OVERHEAD LINES DEPARTMENT.

Applicants should have a civil or electrical engineering qualification, preferably the former, and should have received sound technical training and practical and administrative experience.

The department is principally engaged in the design, supply and erection of overhead transmission lines and overhead railway electrification.

Applicants should write in confidence giving full details of qualifications, experience, age and salary expected to the Manager, Overhead Lines Department, Pirelli-General Cable Works Ltd., Eastleigh, Hants, marking the letter "PERSONAL." 3246

ELECTRICAL ENGINEERS AND DRAUGHTSMAN

A YOUNG Division of an internationally established electrical engineering company located in pleasant rural surroundings in ESSEX invites applications for the following appointments :—

EQUIPMENT DESIGN ENGINEER.

For the design of metal rectifier equipment and transformers. Negotiation with customers and suppliers. Full responsibility from order to shipment.

SALES ENGINEER (Internal).

For the preliminary design of electrical equipments, cost estimation, preparation of tenders and customer liaison.

TRANSFORMER DESIGN ENGINEER.

For the design of transformers up to 50 kVA, with special emphasis on those up to 5 kVA.

For the above posts H.N.C. (Elec.), or equivalent, is preferred. Commencing salaries up to £900 p.a.

DRAUGHTSMAN.

For the design of metal rectifier equipment, including transformers, metal frameworks and cubicles, component assembly layouts, wiring diagrams and schematics. O.N.C. preferred.

Housing accommodation is available to selected applicants. Removal expenses will be paid. The company operates generous holiday, sickness, non-contributory pension and voluntary insurance schemes.

If required, informal discussions can be arranged in Central London during the evenings or Saturday mornings.

Please write to Box 4D P.6643, A.K. Advg., 212a, Shaftesbury Ave., London, W.C.2.

3243

WELSH COLLEGE OF ADVANCED TECHNOLOGY

Cathays Park, Cardiff

Principal : Dr. A. Harvey, B.Sc., F.Inst.P.

ELECTRICAL ENGINEERING DEPARTMENT

APPLICATIONS are invited for two posts of LECTURER in Electrical Engineering, duties to commence on 1st September, 1958.

Salary £1,200 × £30 to £1,350 per annum.

Applicants should possess a university degree, together with teaching and industrial experience.

Application forms (together with further particulars) may be obtained from the Principal, to whom they should be returned as soon as possible.

R. E. PRESSWOOD,
Clerk to the Governors.

April, 1958. 3235

Situations Vacant (continued)

CITY OF SALISBURY, SOUTHERN RHODESIA

Electricity Undertaking

Vacancy for Test Room Assistant (Meters)

APPLICATIONS are invited for the fixed establishment post of TECHNICAL ASSISTANT, Grade 2, in the Test Section of the above-mentioned undertaking. Salary scale is £1,100 × £50 to £1,250 p.a., commencing salary at the minimum. No cost-of-living or other allowances are payable.

The income tax presently payable on the maximum salary for a married man with one child would be approximately £6.

Applicants must be thoroughly experienced in all types of meter testing, particularly high-tension, transformer-operated, polyphase equipments, both kW and kVA, and should be capable of carrying out all duties in connection with a standardising laboratory.

The main duties of this post are :—

(a) Testing and calibrating high-tension and special types of metering.
(b) Standardising instruments and sub-standard meters against potentiometer equipment.
(c) Ratio and phase angle testing of instrument transformers.
(d) Testing all types of instruments and meters, and general supervision of metering work.

The successful candidate must be able to comply with the requirements of the Immigration Authorities, and will be required to submit to the Council a satisfactory medical certificate of fitness.

Applicants should submit full particulars of their technical education, qualifications (if any), training and experience. Details of age, place of birth, nationality and marital state should be given, and copies of not more than three recent testimonials may be included.

Further particulars regarding conditions of service, leave entitlement, allowances toward travelling and removal expenses, etc., are obtainable from Davis & Soper Ltd., 52/54, St. Mary Axe, London, E.C.3, to whom applications must be submitted on or before 23rd May, 1958.

14th April, 1958. 3170

ELECTRICITY AUTHORITY OF CYPRUS

SHIFT CHARGE ENGINEER required by the Authority for two tours each of two years with prospect of permanency.

Salary according to age and experience in scale (including bonus and overseas and temporary allowances) £1,348 rising to £1,582 a year. Gratuity at rate of £150 a year whilst serving on temporary terms. Superannuation scheme similar to C.E.G.B. scheme on admission to permanent establishment. Outfit and settling-in allowances £35 (£75 if accompanied by wife). Children's educational grants in certain circumstances. Free passages and furnished quarters. Liberal leave on full salary.

Candidates, under 45 years of age, must have served an apprenticeship in an engineering works and have had considerable experience in the operation of a modern steam generating station. Preference will be given to candidates who hold a recognised engineering qualification.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/49901/EF. 3264

SURREY EDUCATION COMMITTEE

Kingston Technical College
Fassett Road, Kingston-upon-Thames

REQUIRED for 1st September, 1958, LECTURER in Electrical Engineering in the Engineering Department. Candidates must be Graduates or hold equivalent professional qualifications. Appropriate experience in industry and in teaching is required and research experience will be a recommendation. Salary scale £1,200 × £30 to £1,350 p.a. London allowance payable.

Further particulars and application form on receipt of stamped addressed envelope from the Principal, to be returned as soon as possible.

3317

WALSALL AND STAFFORDSHIRE TECHNICAL COLLEGE

Joint Education Committee

Principal : H. Cheetham, B.Sc.Hons., A.M.I.Mech.E., M.I.Prod.E.

GRADE "B" ASSISTANT IN ELECTRICAL ENGINEERING

APPLICATIONS are invited for the above post, the duties to commence as soon as possible.

Applicants should possess a Higher National Certificate in Electrical Engineering as a minimum qualification, have had training and experience in the electrical industry, and be able to teach Electrical Engineering subjects to Ordinary National Certificate standard.

Salary will be in accordance with the Burnham Technical Report, 1956, viz., £650 by £25 to £1,025 per annum.

Application forms and further particulars may be obtained from the Principal, Walsall and Staffordshire Technical College, Wisemore, Walsall, Staffs., to whom completed application forms should be returned not later than Friday, 16th May, 1958.

V. MILLSON,
Secretary to the Governors.

3302

LANCASHIRE DYNAMO NEVELIN LTD.

Hurst Green, Oxted, Surrey

APPLICATIONS are invited for the following vacancies in our Switchgear Division. Applicants of good education and technical training up to Higher National Certificate, with practical experience of Medium Voltage Industrial Switchgear.

SENIOR DRAUGHTSMAN.

DESIGN DRAUGHTSMAN.

DEVELOPMENT ENGINEER
(experienced in mechanical and electrical testing).

CONTROL GEAR DESIGN & DEVELOPMENT ENGINEER
(required to take charge of control gear development).

Modern clean factory in pleasant country surroundings, usual amenities. The appointments will include entrance to the company's pension scheme.

Please write giving full particulars, including education and technical training and salary required, to the Personnel Manager.

3265

CHIEF DRAUGHTSMAN MOTOR CONTROL GEAR

ESTABLISHED and expanding firm of control gear manufacturers invite applications for the post of CHIEF DRAUGHTSMAN.

Applicants should have had extensive practical experience in the design, layout and development of multi-motor control boards, particularly as regards equipment built to meet customers' special requirements, and be capable of carrying full responsibility for drawing office output and personnel.

Essential qualities are initiative, ability to organise, and a systematic approach.

Applicants should be between the ages of 30 and 45.

Apply in writing, giving details of age, experience and qualifications, to the Secretary, Morecambe Electrical Equipment Co. Ltd., Westgate Works, Morecambe, Lancs.

3227

NOTTINGHAM AND DISTRICT TECHNICAL COLLEGE

Shakespeare Street, Nottingham

Principal :
D. A. R. Clark, M.Sc.(Tech.), M.I.Mech.E.

DUE to an increase in the volume of advanced work, the following additional appointments to the full-time teaching staff are required for September next. The College will, in the main, concentrate in the future on post-Ordinary National Certificate and post-Intermediate City and Guilds work. A large new building costing approximately one million pounds will come into full use in September next, and will provide accommodation for well-equipped Departments of Building and Civil Engineering, Electrical Engineering, Chemistry, Physics and Mathematics, and Mining. Increased accommodation is also available to the Departments of Mechanical Engineering, Arts and Commerce, Printing and Textiles. Research work by both staff and students is being rapidly developed. College senior teaching staff will be expected to undertake or supervise research work. Consultancy work by staff is encouraged.

Industrial experience, teaching experience and research experience will all be of considerable advantage to the selected candidate.

SENIOR LECTURER IN ELECTRICAL UTILISATION.

SENIOR LECTURER IN COMPUTERS OR SEMI-CONDUCTORS.

LECTURER IN ELECTRICAL ENGINEERING—HEAVY CURRENT.

Salaries in accordance with the Burnham Technical Scale as follows :—

Senior Lecturer : £1,350 rising by annual increments of £50 to £1,550 p.a.

Lecturer : £1,200 rising by annual increments of £30 to £1,350 per annum.

Further particulars and form of application may be obtained from the Principal, to whom completed forms should be returned not later than 16th May, 1958. 3303

CENTRAL ELECTRICITY GENERATING BOARD

Civil Engineers

THE CENTRAL ELECTRICITY GENERATING BOARD require suitably qualified CIVIL ENGINEERS for appointments in the SOUTHERN MIDLANDS and NORTHERN PROJECT GROUPS at offices in LONDON, BIRMINGHAM and MANCHESTER respectively.

The successful candidates will be responsible to the Chief Project Engineer and will advise the Project Engineers on all civil engineering and building matters associated with design and construction of the power stations dealt with by the Group. The duties will also include checking designs and examining and advising on tenders for building and civil engineering works. Candidates may indicate a preference for any of the three posts.

Salary within provisional range £2,500-£2,700 p.a. plus £60 London allowance in the Southern Project Group post.

Applications stating age, qualifications, experience, present position and salary should be forwarded to S. S. Scott, Chief Personnel Officer, 24/30, Holborn, London, E.C.1, by 20th May. Envelopes should be marked "Confidential," quoting Ref. ER/116. 3232

CENTRAL ELECTRICITY GENERATING BOARD

General Assistant Engineer (Protection)

GENERAL ASSISTANT ENGINEER (Protection) required in the Electronics and Instruments Section of the Research Laboratories, Leatherhead. Work covers a wide variety of problems arising from the use of protective systems, relays and similar devices. Development of new techniques and fault throwing tests on the system are also carried out. Candidates should have a degree, H.N.C. in Electrical Engineering or equivalent, and preferably some experience in this field. Salary £550-£725 per annum.

Applications stating age, qualifications, experience, present position and salary should be forwarded to S. S. Scott, Chief Personnel Officer, 24/30, Holborn, London, E.C.1, by 16th May. Envelopes should be marked "Confidential," quoting Ref. ER/117. 3230

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable appointment:—

PRINCIPAL ASSISTANT
Chief Commercial Officer's Department,
Board Headquarters, Glasgow.

Candidates should possess good general experience of all branches of advertising, copy writing and production of sales literature and brochures. The ability to write precise descriptive matter and articles dealing with the utilisation of electricity are essential qualifications. Knowledge of the electricity supply industry would be an advantage.

This post, which is presently located at 206, St. Vincent Street, Glasgow, C.2, will be transferred to the Board's new Headquarters in Cathcart in approximately one year.

Salary £1,285/£1,405 per annum in accordance with Grade 9 of the National Joint Council (Administrative and Clerical Grades) Salary Scales.

Apply, quoting Reference No. G2/58 on standard form AE6, available from the Secretary, P.O. Box 173, 351, Sauchiehall Street, Glasgow, C.2, not later than Friday, 23rd May, 1958.

(Note: This post was previously advertised on 26th August and 18th December, 1957. Applications received at that time have been retained for further consideration).

22nd April, 1958. 3304

TENDERING AND CONTRACTS ENGINEERING

'ENGLISH ELECTRIC'
STAFFORD

THE company wishes to appoint a number of electrical engineers to undertake technical co-ordination work at the tendering and contract stages in the following fields:—

MINING.
METAL INDUSTRIES.
INDUSTRIAL PLANT.
POWER TRANSFORMERS.
POWER SYSTEMS METERS AND RELAYS.
SWITCHGEAR.
RECTIFIERS.

Applicants should have relevant electrical engineering experience and hold H.N.C. (E.) or equivalent qualification.

Junior engineers who are studying for their H.N.C. (E.) and are considered to have the ability to do this work will be considered for training.

These are pensionable staff appointments. Careful consideration will be given to the housing problem, where possible.

Please write giving full details to Dept. C.P.S., 336/7, Strand, London, W.C.2, quoting Reference ER.1297N.

3282

YOUNG MAN

required for Contracts Department

of an old-established Engineering Firm handling Railway Equipment, including Lighting and Heating.

The duties will be compilation of estimates and preparation of tenders for submission to railways and carriage builders throughout the world.

Applicants should preferably have had practical experience in electrical work and should have reached at least Ordinary National Certificate standards.

Please write:

Box 2VP 8339, A.K. Advg., 212a, Shaftesbury Avenue, London, W.C.2.

3278

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Area

APPLICATIONS are invited for the position of FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER in the Rutherglen District.

Applicants should be engineers with commercial experience, and preferably should hold an appropriate engineering qualification. The position is superannuable.

The salary and conditions of service will be in accordance with the National Joint Board Agreement, Schedule A, Classification and Grading F.6, salary £935/£995 per annum.

The successful applicant will require to reside within a reasonable distance of the Rutherglen district office.

Application forms, which may be obtained from the undersigned, should be forwarded to this office within 14 days of the date of this advertisement.

R. J. RENNIE,
154/156 Montrose Crescent, Manager.
Hamilton. 3305

JOSEPH LUCAS
(ELECTRICAL) LIMITED

Great King Street, Birmingham, 19

ENGINEER

EXPANSION of development of ignition equipment for gas turbines and allied projects creates a vacancy for a practical engineer with experience of design for economic production of electrical apparatus. The work is of a high technical standard and applicants should preferably possess an honours degree.

The post is permanent and pensionable and offers considerable scope for advancement to a progressive engineer.

Apply in writing stating age, qualifications and experience to the Personnel Manager, Joseph Lucas (Electrical) Ltd., Great King Street, Birmingham, 19, quoting reference PM/D/190.

128

D.C. MACHINE DESIGN

DESIGNER required who is capable of assessing and overcoming the problems associated with the design of highly rated D.C. motors for use as starters and actuators. An opportunity also exists to join a team dealing with the starting of industrial gas turbines.

This work would suit a graduate engineer, but the essential qualifications are the ability to determine heat flow under operating conditions in existing and novel machines, and a flair for basic machine design.

If you are interested in such a post in the West London area, please apply to

Box 3256.

ELECTRICAL DRAUGHTSMAN

YOUNG man, preferably with O.N.C. and apprenticeship served. Experimental work on machine tool control gear, electro-mechanical assemblies and related work.

Excellent training and prospects available with Europe's largest makers of gear cutting machine tools.

Send full details of age, education, experience and present salary to—

Personnel Manager
W. E. SYKES LTD.
Manor Works, Staines

3245

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ASSISTANT ENGINEER (Coal and Ash Handling) is required for Stourport "A" and "B" Power Stations. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade K.12, £835-£880 per annum.

The successful applicant will be required to supervise the coal and ash disposal operations, and should preferably have experience in the organisation and control of transport vehicles.

Apply, quoting Vacancy Number 784MD, on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 13th May, 1958. 3260

ELECTRICAL DRAUGHTSMAN

required by

W. H. ALLEN SONS & CO. LTD.
BEDFORD

for work on A.C. and D.C. motors and generators.

This is a permanent appointment on interesting work with good prospects.

Generous pension scheme.

Assistance towards removal expenses.

Apply in writing, giving full details of experience to Personnel Manager, W. H. Allen Sons & Co. Ltd., Bedford.

3281

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

FOURTH ASSISTANT ENGINEER (Planning), required in the Sub-Area Engineer's Department, No. 4 Sub-Area Headquarters, Rhostyllen, Near Wrexham. Salary within range £790/£835 per annum (N.J.B. K/13).

Applicants should have had experience of the design, construction and operation of distribution systems, and a knowledge of the technical and economic factors in system layout and design. Technical qualifications desirable.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager at the above address. Closing date, 14th May, 1958. 3306

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division
Vacancy No. 45/ER/58.

APPLICATIONS invited for superannuable N.J.B. appointment of STATION SHIFT CONTROL ENGINEER, USKMOUTH POWER STATION, near Newport.

Salary K.10, £935 × £20 to £995 per annum.

Experience in modern generating station essential. H.N.C. or equivalent qualifications desirable.

Application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 16th May, 1958.

3279

TRANSFORMER ENGINEER

A WELL-known company will shortly have a vacancy for a CHIEF TRANSFORMER ENGINEER.

This is an important appointment, with considerable scope, and with excellent prospects for the right man, and carries a salary appropriate to the responsibility involved.

All applications will be in strict confidence. Existing staff has been been informed.

Reply to—Box 3280.

TECHNICAL SALES REPRESENTATIVE

for Greater London and Home Counties.

Generous salary/commission/expenses. Post last year worth over £1,300. Must own car. Pension scheme; five-day week.

Only applicants with experience, initiative and dynamic personality will be considered.

Full details to Man. Dir., British Central Electrical Co. Ltd., 6, Rosebery Avenue, London, E.C.1. 3268

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY GENERATING BOARD

Instrument Engineers

INSTRUMENT ENGINEERS required in the Electronics and Instruments Section of the Research Laboratories, Leatherhead, Surrey. The section provides an instrument service for all departments of the laboratories and duties include the maintenance, calibration and repair of the wide variety of physical, chemical and electrical instruments.

Candidates should have the Higher National Certificate, and experience in electronic or nucleonic equipment will be an advantage.

Salaries within scales £820 - £995 p.a. or £550 - £725 p.a.

Applications stating age, qualifications, experience, present position and salary should be forwarded to S. S. Scott, Chief Personnel Officer, 24/30, Holborn, London, E.C.1, by 19th May. Envelopes should be marked "Confidential," quoting Ref. ER/115. 3231

CHIEF ELECTRICIAN

PARKE, DAVIS & COMPANY LIMITED

APPLICATIONS are invited for the vacant position of CHIEF ELECTRICIAN. Candidates should be between 30 and 40 years of age, hold at least H.N.C. in Electrical Engineering, and have had a minimum of 3 years' experience in a supervisory capacity, including the control of labour, preferably in the pharmaceutical or chemical industry. The position involves the supervision of a permanent staff of electricians engaged on the maintenance of plant and machinery, the planning of electrical services for new projects, and the control of new installations.

The salary will be commensurate with the responsibility of the position, which is pensionable and covered by a life assurance plan.

Apply in the first instance in writing, giving the fullest possible information of past experience and positions held, to Personnel Manager, Parke, Davis & Company Limited, Staines Road, Hounslow, Middlesex. 367

ASSISTANT ELECTRICAL FOREMAN

THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY, Industrial Group, requires an ASSISTANT FOREMAN at Chapelcross Works, Annan, Dumfriesshire, Scotland, to be responsible to the Electrical Foreman for the maintenance and testing of protective systems and relays associated with E.H.V., H.V. and M.V. networks and for the relative records.

A recognised electrical engineering apprenticeship and full conversancy with the care and maintenance of a wide variety of protective relays are essential. Possession of O.N.C. or equivalent in electrical engineering may be an advantage.

Salary £700 (at age 26) to £875.

Contributory pension scheme.

A house or legal expenses on house purchase may be available.

Send postcard for application form, quoting reference 2410, to Works Secretary, Chapelcross Works.

Closing date 19th May, 1958. 3263

FORD MOTOR COMPANY LIMITED

have a vacancy in their Power Services for an

ENGINEERING ASSISTANT.

Applicants should be experienced in the economic operation and maintenance of large industrial E.H.T. generation and transmission systems, with a knowledge of high-pressure steam plant (P.F. fired), auxiliary and control equipment. Knowledge of new plant development will be an advantage. A recognised works apprenticeship with technical knowledge up to H.N.C. (Elec.) standard is essential.

Salary in accordance with experience and qualifications. Non-contributory pension scheme.

Please write to Training and Recruitment Department (O.12 A), Ford Motor Company Limited, Dagenham, Essex, quoting reference TEP. 3266

A COMPANY of the Expert Tool Group requires senior designer-draughtsmen experienced in the design of contactors allied to the motor control gear field. Salary will be paid commensurate with qualifications and experience. Assistance with housing to suitable applicants. Write stating full details to—Chief Draughtsman, Sharp Control Gear Ltd., Lount Works, Ashby-de-la-Zouch, Leics. 3121

A VACANCY will shortly occur in East Anglia for a representative in the electrical department of Bulpitt & Sons Limited. Only those with sound connections in the electrical industry, and preferably between the ages of 28 and 40, should apply. Car provided. Pension scheme, etc. Applications stating previous experience should be addressed to Sales Manager, Electrical Department, Bulpitt & Sons Limited, 132, Icknield Street, Birmingham, 18. 3247

A WELL-established London contractor (nearing retirement) requires man skilled in contracting (aged about 25/35) to take complete charge. Substantial profit share to right man of at least £15 per week. Eventually to take over business; no capital required. Details of experience, etc., to—Box 3284.

AERO RESEARCH Limited (manufacturers of synthetic resins) wish to appoint a laboratory technician with laboratory electrical experience. He (or she) should preferably be aged under 30 and should have an H.N.C. in Electrical Engineering. The work to be undertaken is connected with the electrical properties and use of synthetic resins. Candidates should send itemised particulars to — Aero Research Limited, Duxford, Cambridge. 3255

AN organisation comprising a group of companies engaged in the manufacture of heating and air conditioning equipment requires the services of a fully qualified electrical engineer (M.I.E.E.) to develop the sales, design and contracting for electrical installations. The post offers wide scope and prospects. Write stating age, qualifications and salary required to Box 3285. All applications will be treated in strict confidence.

ARMATURE winder. Progressive firm have vacancy for skilled man having sound knowledge all types A.C. and D.C. work.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566). 3054

ARMATURE winder wanted with repair shop experience, also preferably accustomed to outside installation breakdowns of motors and control gear. — Dow & Nicholson Ltd., 10, Wellington Place, Aberdeen. 3286

ARMATURE winders: Working foreman and winder required. Sound knowledge A.C. and D.C. work. Uxbridge area.—Box 3015

ASSISTANT electrical engineer, aged 25-30 years, with experience of lighting and power schemes and M.V. distribution, required for varied work in Westminster office of consulting engineers. Staff canteen and pension fund available. Preference given to applicants with H.N.C. Details and salary required to—Staff Officer, Rendel, Palmer & Tritton, 125, Victoria Street, London, S.W.1 (Victoria 8494). 3236

ASSISTANT engineer required with experience in the design and layout of automatic control and switchgear. Apply in confidence—Electro Dynamic Construction Co., Ltd., Control Gear Division, Bristol Road, Bridgwater, Somerset. 3212

AUSTRALIA. Applications invited. Electrical engineer with managerial ability and sound knowledge small/medium transformer manufacture. Write with full details academic qualifications and experience.—Box No. 1685, c/o Charles Barker & Sons Ltd., Gateway House, London, E.C.4. 3269

BRANCH manager required for South Wales electrical contractors' office. Reply in the first instance to Box 3237, giving details of experience.

COMMISSIONING engineer, aged 35 to 50 years, with wide experience of commissioning of power station plant or similar heavy industrial plant. To be responsible to chief engineer for formulating and implementing a comprehensive commissioning programme for complete nuclear power station. Must be willing to travel and capable of accepting major responsibility. This is a senior and pensionable post. Minimum qualification A.M.I.Mech.E., A.M.I.E.E. or equivalent. Applications giving age, details of education, qualifications and experience to — Chief Resident Engineer, The General Electric Co. Ltd., Hunterston Nuclear Generating Station, West Kilbride, Ayrshire. 3192

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE Co. Ltd., 24, Fennel St., Manchester, 4. The company has a vacancy for an electrical surveyor. Permanent position carrying progressive salary scale £735 to £1,060 and non-contributory pension. Candidates, age 26 to 32, preferably with H.N.C. in Electrical Engineering or Grad. I.E.E., and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply in own handwriting, stating age, qualifications and experience. 3277

CHIEF engineer for large contract in Pakistan. Fully experienced in all types of electrical installation on schedule rates, including overhead and underground cables. Salary £2,700 p.a., expenses £300 paid in rupees, free unfurnished bungalow, car and chauffeur. To commence September next. Apply to B. French Limited, Pike Mills, Kidderminster, giving full details and references. 3238

CONTROL gear engineer required, age 23-35, for layout and circuiting of contactor equipment. Good salary. Permanent and progressive position. Canteen, pension scheme. Write stating age, experience and qualifications, if any, to Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 273

CROMPTON PARKINSON Limited seek to appoint a chief engineer controlling the design and development of lead acid batteries at their Newport (Mon.) works. The successful applicant will be in charge of the design and technical development of an extensive range of car starter, commercial and traction batteries, and will, in addition, control both the electrical and chemical laboratories. An excellent salary is offered and candidates must have a wide knowledge of battery design and manufacture. The appointment is superannuated, staff amenities are good, and a house can be made available. Applications, which will be treated in full confidence, should be sent to the Chief Personnel Officer, Crompton Parkinson Limited, Aldwych, London, W.C.2, and envelopes should be marked "C.E.N." 3310

DESIGN engineer required for electrical automatic and hand control gear. Must have knowledge of electronics. Progressive position; substantial salary; superannuation.—Box 3272.

DESIGN engineer with H.N.C. required for interesting and varied work on power transformers and voltage regulating devices. Company expect to pay not less than £850 p.a. Situated 30 miles from London. Housing available. Superannuation scheme. Apply in confidence giving academic qualifications and career to date.—Box 3248.

DESIGNER-draughtsman, senior, electrical, required. Experience is preferred in the application of diesel-driven generating machinery up to 200 kW and its associated control gear, including portable, standby, automatic mains failure equipment, etc. Experience essential in control gear and circuit layout. Good salary offered. Pension scheme. Canteen facilities. Reply for the attention of the Chief Engineer, Henry Meadows Limited, Fallings Park, Wolverhampton. 3241

DRAUGHTSMEN, both senior and junior required. Applicants should have either contract development or diagram experience on switchgear up to 11 kV, although men with good electrical or mechanical knowledge will be considered. Excellent working conditions. Good prospects. 5-day week. Superannuation fund. Interviews arranged Saturdays if desired. Apply giving full details of training and experience to Personnel Officer, Crompton Parkinson (Chelmsford) Limited, Chelmsford, Essex. 368

DRAUGHTSMEN required for contracts office dealing with airbreak and oilbreak medium voltage switchgear. Previous experience of motor control switchboards would be an advantage. Superannuation and staff bonus schemes. Possible assistance with housing to selected applicants. The company is in a rural district within six miles of the coast. Write stating previous experience, age, etc., quoting ref. CO/2, to—Ottermill Switchgear Ltd., Ottery St. Mary, Devon. 3311

ELECTRICAL engineering draughtsmen required for complete electrical installation and design work, including motor application and control scheme engineering. Top salaries, pension scheme, living allowance until removal effected, removal expenses paid and assistance in housing. Apply—The Power Gas Corpn. Ltd., Stockton-on-Tees. 3093

ELECTRICAL contractors, S.E. Essex, require working foreman electrician. Must be good tradesman, capable supervising small contracts. Driving licence. Domestic and industrial installations. State age, training and experience.—Box 9337.

ELECTRICAL engineer to take charge of works electrical department. Experience of H.T. and L.T. switchgear and distribution necessary. Knowledge of electric furnaces an asset. Minimum qualifications H.N.C. or equivalent. State age, qualifications and salary required to—Box 3312.

ELECTRICAL engineering assistant reqd. with expce. of maintenance of electric lifts or similar equipt. Pensionable. Salary up to £860. Prospect of promotion for those obtaining H.N.C. (Elec.). Applicn. form from Chief Engineer (58/41), L.C.C., County Hall, London, S.E.1. (735) 3239

ELECTRICAL engineers. Juniors 20/24 years required to assist in the preparation of control schemes and specifications for electrical equipment for mechanised electric and gas-fired heat treatment furnaces and for induction heating equipment. O.N.C. or H.N.C. in Electrical Engineering desirable, according to age. Apply by letter to—Personnel Manager (F.C.), Birlec Ltd., Tyburn Road, Erdington, Birmingham. 3214

ELECTRICAL engineers required for consulting engineers' office. Senior to take charge of projects, carrying out the design of lighting and power installations for all classes of buildings. Also intermediate designer-draughtsman for the same class of work. Five-day week, spring and summer holidays, pension scheme and luncheon vouchers. Apply in writing stating age, experience and salary required to—J. Roger Preston & Partners, 15, North Audley Street, London, W.1. 3250

ELECTRICAL firm with attractive retail showroom and small contracting business of good standing requires capable electrician with high standards of service; able to drive. N.W. London. Good prospects for keen man prepared to train for responsible position. State age and full details of career.—Box 9346.

ELECTRO-mechanical draughtsmen required for production drawing office of company engaged in the manufacture of control gear equipment. Good salaries paid to "first-class" men. Canteen facilities, pension scheme. Housing assistance considered in approved cases. Write giving age, experience, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middx. 275

ENGINEERING company in West Africa importing electrical machinery and equipment manufactured by firms of world-wide repute requires an engineer capable of developing the sale of these products in a rapidly expanding market. Applicants, who should be under 35, must have had experience in the selling field, backed by a wide practical experience. Qualifications should be at least to H.N.C. Commencing salary will be £1,400 per annum. In addition there are family allowances; free furnished accommodation is provided, together with free first class passages to and from Africa, and free medical attention in Africa. Tours of about 21 months are each followed by substantial leave on full pay. Membership of pension fund. Apply giving full details of qualifications and experience to—Box 3270.

ENGINEERING graduate (electrical and/or mechanical), preferably with some industrial experience, required for interesting and diverse work on new processes and plant. Knowledge of electronics an advantage. Oldbury/Smethwick area, nr. Birmingham.—Box 3240.

ENGINEERS required for the erection of lattice tower and wood pole overhead transmission lines, willing to serve either at home or overseas. Applicants should have a technical background up to H.N.C. (Electrical) standard. Experience desirable but not essential. Pension fund. Write giving full particulars and quoting reference C/76/55 to—Personnel Officer (Staff), British Insulated Callender's Construction Company Limited, 30, Leicester Square, London, W.C.2. 175

J. A. CRABTREE & Co. Ltd., Walsall, require design engineers for control gear development. Applicants should have experience in this field and be capable of initiating all detail development without supervision. It is desirable that candidates hold at least H.N.C. (Electrical). Applications stating age, experience and salary required should be addressed to the Technical Director, Lincoln Works. 3287

FOREMAN, first-class electrical installation work, required by large firm electrical engineers and contractors. Excellent opportunity. Write age, experience, copy references.—Box 3193

J. A. CRABTREE & Co. Ltd., Walsall, require senior designers with experience in domestic and industrial electrical accessory development. Applicants should be capable of initiating detail development with a minimum of supervision. Applications stating age, experience and salary required should be addressed to the Technical Director, Lincoln Works. 3313

JUNIOR design engineer having O.N.C. offered interesting and varied work on power transformers and voltage regulating devices with progressive company 30 miles from London. Starting salary not less than £550 p.a.—Box 3249.

JUNIOR draughtsman required for electrical department of illuminating and general engineers. Some experience switchgear layouts and circuit diagrams essential. Clapham (London) area.—Box 3251.

MANAGER assistant, 25-35 years, required by electrical contractor engaged on building installations to handle all internal technical and office procedures. Good draughtsman able to prepare schematic layouts and experienced estimating, buying, etc. Pension scheme. Excellent opportunity. State age, experience and salary required.—Box 3273.

MANAGER. Electrical contractors engaged on installation contracts for large office blocks, schools, flats and industrial buildings require a capable and experienced manager. Applicants should have sound practical knowledge estimating and possess good technical administrative and negotiating ability with capacity for assuming full responsibility and control. Pension scheme, attractive conditions and excellent prospects to selected applicant. State age, qualifications, experience, present salary, availability.—Box 3194.

REPRESENTATIVE required by leading electrical manufacturers for Kent and East Sussex with knowledge of accessories and switchgear. Full particulars in confidence, stating experience, age, salary required, and if car driver, to—Box 3252.

REPRESENTATIVE resident Bristol area for S.W. England and S. Wales for Temco wiring accessories. Good salary, commission, expenses for experienced man with personality and contractor connection. Car provided. Pension scheme. Holiday arrangements respected. Write in confidence stating experience, age, remuneration required, to Mr. S. M. Harris, T.M.C.-Harwell (Sales) Ltd., 37, Upper Berkeley Street, London, W.1. 3195

SALES engineer for Glasgow office of electric motor manufacturers. Scope for advancement for person possessing Ordinary National or equivalent. Applications in confidence should be made in writing, giving full details of age, experience and salary required.—Box 3314.

SALES engineer required for electrical division of company manufacturing generating sets up to 160 kW output. Applicants should have Higher National Certificate in Electrical Engineering or equivalent. The commencing salary will be commensurate with experience and qualifications and there will be ample scope for advancement. Applications will be treated as confidential and should be made in writing giving full details of age, experience and qualifications, to—Sales Director, Henry Meadows, Ltd., Fallings Park, Wolverhampton. 3155

SALES engineers for electric motor manufacturers for London and Midland areas. Permanent and progressive appointments, superannuation scheme, salary, commission and expenses. Apply in confidence giving full details of previous experience, age and salary.—Box 3219.

SALES representative. Applications are invited for an experienced sales representative to cover Yorkshire. Applicants must be resident in the Leeds area and preferably with connections amongst electrical wholesalers and electrical trade. Commencing salary will be paid according to age and experience. The position offers good prospects and is pensionable. Please write, in confidence, giving age, sales experience, etc., to the Branch Manager, The Metallic Seamless Tube Co. Ltd., 4, York Place, Leeds. 3253

SENIOR design development engineer required by well-known progressive manufacturer of rotating electrical equipment. Real opportunity for a younger man with ability and experience. Full details of qualifications, experience, salary and age.—Box 3224.

SALES representative required, N.W. and W. London postal areas, by wholesale electrical and radio distributors. Salary, commission, expenses, car allowance and superannuation. Write giving full details of experience, etc., to Branch Manager, Simpson, Baker & Co. Ltd., 24/30, Gillingham Street, London, S.W.1. 3288

SWITCHGEAR sales engineer required at head office to handle enquiries and orders for power and substation switchgear. Applicants should preferably have attained H.N.C. standard and have had previous switchgear experience. Write Personnel Officer, Ferguson Pailin Ltd., Higher Openshaw, Manchester, 11. 3289

TECHNICAL assistant to designer required (age 20/28). Should have some acquaintance with design of automatic electric motor control gear, also electronic and magnetic amplifiers. Progressive position, attractive salary, superannuation.—Box 3271.

TECHNICAL estimator required for responsible position in small electrical manufacturing unit in North London dealing with a range of medium duty switchgear, switchboards, sheet metal work, etc. Experience of shop floor techniques and customer contact advantageous, together with qualifications to Higher National Certificate standard. Attractive salary and pension scheme.—Box 3290.

TRANSFORMER design engineer required who is interested in dealing with a wide range of design problems from instrument transformers to 3,000-kVA power transformers. Apply giving details of past experience, age and salary required to—Personnel Officer, Foster Transformers Ltd., London, S.W.19. 3182

TRANSFORMER designer and draughtsman, senior. Fully experienced on all types transformers up to 500 kVA. Commencing salary over £1,000 p.a. is envisaged. The appointment offers scope for advancement and will be progressive. Apply in the first instance in writing: Willesden Transformer Co. Ltd., Manor Park Road, Harlesden, London, N.W.10. 3077

WORKS manager for Yorkshire firm of electrical engineers, to control modern repair works. Must be capable of estimating for and dealing with rewinding, conversions and overhauling of motors, etc. Outside installation of electrical plant and controlling of staff. Apply stating age, experience, salary required, etc.—Box 3233.

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

BRITISH electrical engineer, B.Sc., A.M.I.E.E., retiring, aged 50, from post in India and Burma after 24 years' continuous service, seeks further employment.—Box 9340.

ELECTRICIAN seeks o/sea employment. Experience on number of overseas contracts.—Box 9335.

ENGINEER, wide experience contracting, installation design, site supervision, A.M., factory, brewery, cement plant and quarry maintenance.—Box 9348.

EXECUTIVE (35), A.B.I.M., experience gen. management, seeks position offering scope and interest, demanding initiative and integrity.—Box 9336.

REPRESENTATIVE, good connections with industrial, contractor and retail customers, desires change. East London/Essex area; wholesaler or manufacturer.—Box 9351.

TELEPHONE engineer (37), family man, requires responsible posn., o/seas prefd. Specialised in design, instn., mtce., auto. and manual eqpt. Some cable, subs. eqpt., estimates, etc. Exp. with B.P.O., o/seas admins. and U.K. manufr. Can handle staff. Plenty of work essential. Present rem. exceeds £3,000 p.a.—Box 9345.

ARTICLES FOR SALE

ELECTRIC HOUSE SERVICE METERS

PREPAYMENT and credit, 200/250 v. A.C., 8/p., 50 c., 2½-100 A. Fixed or variable tariff. Reconditioned, fully tested and guaranteed 2 years. Prompt delivery, carriage paid.

ALBERICE METER COMPANY
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(Tel. MOUntview 7944, 6373) 191

***Articles for Sale** (continued)*

NEW OXFORD TRANSFORMER WELDERS
for Immediate Delivery

160/450-amp. sizes, oil-cooled pattern for operation on 400/440-v., single-phase, or 200/240-v., dual welding voltage 50/80; in-built coarse and fine regulators.

Prices as follows :—

450 amps.,	£135 0 0
350 amps.,	£99 10 0
250 amps.,	£71 0 0
180 amps.,	£45 0 0

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H.P.	Voltage.	Maker.	Remarks.
375	200/220	MET-VICK.	Automatic
240	220	ALLEN	Drum
225	250	BROOKHIRST	M.L.
195	220	IGRANIC	Automatic
150	500	BROOKHIRST	Drum
110	220	ALLEN WEST	Drum

Other starters available, all sizes.

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Wood Lane, London W.12
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A.A. ELECTRICAL Co. for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI. 5105. 67, Rothschild Rd., London W.4. 57

A 1,100-kW turbo-alternator by Richardson Westgarth/Mather & Platt (1928), in running order. Turbine 210 p.s.i., 650° F.; alternator 3,300 volts, 3-phase, 50 cycles. Complete with condenser, extraction and circulating water pumps, with 460-volt D.C. motor drive.—Corporation Electricity Department, Douglas, Isle of Man. 3234

A BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish vertical, etc.—Burford, Taylor & Co. Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. 1/- slotmeters. Guaranteed 2 years, 2½-50 amps. From 50/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 4487). 169

ALMOST new 10-h.p. Brook slipring motor, 710 r.p.m., 415/3/50, cont. rating, c/w starter, £50.—Axon Motor Re-winding Co. Ltd., 536, Moseley Road, Birmingham, 12. 3080

ALTERNATORS from ½ to 675kVA in stock, single and three-phase, all voltages and frequencies. Guaranteed. Many unused. Send your requirements.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 162

ALTERNATORS, generators, 1-100 kVA, all voltages. Specialists—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 147

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

BARGAINS in electric motors are always being obtained from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Stocks include A.C. and D.C. motors, second-hand and new up to 30 h.p. Starters, slide rails and pulleys. Ring Mon. 3355 for your requirements. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 140/-. See Quarterly.—Tradex, Surbiton. 170

BRAND new 7½-h.p. E.E.C. slipring motor, 400/3/50, 950 r.p.m., cont. rating, c/w starter, £55.—Axon Motor Re-winding Co. Ltd., 536, Moseley Road, Birmingham, 12. 3079

CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists. — Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

CABLE, underground, all types ex stock.—E. M. Tatton Co. Ltd., Kew Bridge, Brentford (EALing 3155/6). 117

CIRCUIT breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards. — Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

COIL winder, Nevilles automatic, winds 16-42-s.w.g. wire, for coils 12" dia. × 12" long maximum, 1" minimum, with reel stand. Little used.—Box 3291.

CONVERTERS and motor-alternators, 24, 110 and 220 v. D.C. to 230/1/50 A.C., 125 watts to 6 kVA in stock.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

ELECTRIC motors, generators, control gear, transformers, A.C. and D.C., new and reconditioned; all covered with our usual 12 months' guarantee; large stocks available.—Electropower Co. Ltd., Kingsbury Works, Kingsbury Road, London, N.W.9 (Colindale 4621-2). 42

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

ELECTRICIANS. Send for details Shaftesbury lightweight "Bantam" ladders. Top sections fitted with patent moulded rubber blocks, eliminate possibility of scratching or marking walls, fascias, and other painted or highly polished surfaces. Also available for immediate delivery, steps, platform steps, trestles, telescopic trestles, pole and builders-type ladders, and all sizes of two and three-section extension ladders.—Shaftesbury Ladders Ltd. (E.R.), 453, Katherine Road, London, E.7 (Phone: Grangewood 3363/4). 111

FLAMEPROOF switchgear, lighting fittings, conduit fittings, motors, etc., always in stock.—Leighton Warehouse Co., 6, Church Road, Linslade, Leighton Buzzard, Beds. (Tel. No. L.B. 3400). 9341

FLUORESCENT fittings, lamps, starters and control gear for home and export. Fully guaranteed by actual manufacturers. Send for catalogues. — The Anglo-American Electrical Company, Olive Street, Bury, Lancs. 245

FLUORESCENT tubes reconditioned and guaranteed as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks.—The Anglo-American Electrical Company, Bury New Road, Breightmet, Bolton, Lancs. (Telephone, Bolton 7251). 212

FREQUENCY changers and variable frequency M/A sets in stock, and to specification.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 148

GENERATING plants of all types, new and reconditioned up to 100 kVA in stock. Special plants built to order at short notice; automatic mains failure, etc.—Powerco Ltd., 312, York Rd., London S.W.18 (VAN. 5234). 151

GENERATING sets for sale, petrol, diesel and steam, from 1 kW up to 700 kW. A.C. and D.C. switchboards.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 163

HIGH frequency alternators and converters, 400 to 2,600 cycles up to 6 kVA in stock. Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 149

HOUSE service meters, C. & H., Aron, E.A.C., 20-240 v. A.C., s.-ph., 50 c., 5 amps., 17s. 6d.; 12.6d. postage.—Universal Electrical, 217-221, City Rd., London, E.C.1. 37

MOTOR generator sets and converters, all sizes and voltages from ½kW up to 500kW in stock. — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

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PATENT NOTICES

THE proprietor of British Patent No. 666741 for "Improvements in and relating to testing devices for armatures and stators of dynamo electric machines" desires to enter into negotiations with a firm or firms for the sale of the patent, or for the grant of licences thereunder. Further particulars may be obtained from—Marks & Clerk, 57 & 58, Lincoln's Inn Fields, London, W.C.2. 3298

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COMPANY MEETINGS

ABERDARE CABLES (HOLDINGS)

Full Order Books

THE 22nd Ordinary General Meeting of Aberdare Cables (Holdings) Limited was held on 25th April in London, Sir John Pascoe (the Chairman) presiding.

The following is an extract from his circulated review :—

We are asking the shareholders to approve a Special Resolution changing the name of the company to ABERDARE HOLDINGS LIMITED as being a more appropriate title, having regard to the fact that the operations of the companies in the Group cover not only the manufacture of Cable, but Electric Switchgear, Transformers, Water Treatment Plants and Boiler Auxiliary Equipment.

The accounts for the year show profits before taxation of £608,795 as compared with £590,688 for the year ended 31st October, 1956, the corresponding figures after taxation being £262,583 as against £253,113.

Aberdare Cables Limited

The amount of Cable manufactured was slightly in excess of that for the previous year, which we consider satisfactory having regard to the existing Government restrictions on capital investment.

We have maintained our proportion of the export trade although opportunities in this field are increasingly difficult due to the establishment of indigenous manufacture in many countries.

The amount of work in hand leads us to expect that the results of the current year will not differ very greatly from the previous year always provided that we are not faced with increased manufacturing costs.

South Wales Switchgear Limited

The year under review has been one of continued expansion. New records have been established in the number and value of orders received, output achieved and work in hand.

The outstanding feature is the extensive demand for our new products, particularly the outdoor 33,000-volt Package Station Metalclad Switchgear. Orders have been received from all parts of Great Britain and, more significantly, from abroad. The Package Station Switchgear now includes 15,000-volt equipment, and again this new design has resulted in many orders from home and overseas. I am also pleased to report the expansion in our 11,000-volt range, with particular reference to Power Station Auxiliary Switchgear.

Our experience in transformers has not been dissimilar to that in Switchgear.

South Africa. Our subsidiary, South Wales Electric (Pty.) Limited, is making satisfactory progress and additional capacity has been acquired to deal with the increased flow of work.

Canada. Last year I reported that our associated company, Electric Switchgear (1953) Limited, was now on a profit earning basis, and indeed we have received a dividend from them in the year under review.

Aberdare Engineering Limited

The factory output has been well maintained, and large contracts have kept the new Fabrication Department operating to full capacity.

The specialised products of our associated companies have provided an excellent "base-load" during the year, but new developments now in progress should prove satisfactory additions to our extensive manufactures.

Ivor Power Specialty Co. Ltd. Output during the year has been well maintained in the home and export markets, and we commence the new financial year with a well filled order book.

Neckar Water Softener Co. Ltd. Our invoicings for the year were in excess of the previous record year. We commence the current year with a satisfactory backlog of orders, and fell confident that we shall equal last year's trading.

In general the results of the year ended 31st October, 1957, were rather better than those of the previous year, and with full order books and loyal, keen and efficient staff we have reason to anticipate that the present year will be as satisfactory as the two previous years.

The report was adopted and a total distribution of 17½% was approved.

A Resolution changing the name of the company to Aberdare Holdings Limited was also passed. 3228

TELEGRAPH CONSTRUCTION & MAINTENANCE COMPANY

A Most Satisfactory Year

THE 94th Annual General Meeting of The Telegraph Construction and Maintenance Co. Ltd. will be held on 15th May in London.

The following is an extract from the circulated statement of the Chairman and Chief Executive, Sir John Dean, B.Sc., A.R.I.C., F.I.R.I.:—

The Group Profit for the year before taxation, £626,274, is 26% above that for the previous year. Turnover showed a very slight increase over that for 1956 but, in making this comparison, it must be borne in mind that the price of copper fell from £260 per ton in January to £180 per ton in December. This means an increase in volume of turnover of nearly 10%. Exports, too, have been well maintained and similar remarks apply.

We have been able to agree our liability for Excess Profits Tax on the finalisation of our claim for deferred repairs; this has been responsible for approximately £120,000 of the £131,725 described in the Profit and Loss Account as "Refund of Excess Profits Tax and other Taxation."

We have retained in our Subsidiary Companies such amounts as are considered necessary to finance their capital expenditure plans and maintain fluidity.

Your Directors have given very careful thought to the question of distribution, and have decided to recommend a final dividend of 3½% as for 1956, but to increase the cash bonus from 1% to 2½%. The additional cash bonus should be regarded as peculiar to the year in view of the large taxation credits which have been brought into the accounts, and which are related to past years.

Despite extremely difficult trading conditions, particularly in regard to the considerable reduction in the price of copper and the very highly competitive nature of the business, the Cables Group has succeeded in attaining a moderate profit.

There is no doubt, however, that on the whole the Cable Industry of Great Britain is over-equipped in relation to demand, which of necessity is bound to raise costs and thereby depress profits. Some form of integration and rationalisation within the industry is desirable, and in this connection the Directors are very actively engaged in endeavours to improve the position.

Submarine Cables Ltd. is suffering to some extent from the Treasury squeeze and the consequent drop in orders. Whilst the long term prospects are fair, profits are likely to be somewhat meagre in relation to the specialised nature of the business and the reliability and quality which are rightly expected. There is reason to anticipate, however, that the income we receive from this business will be maintained.

The Metals Group has again made a most valuable contribution to the profits of the year. The Group succeeded not only in maintaining output, but exceeding the budgeted sales and profits. The two main subsidiaries of the Group, Magnetic & Electrical Alloys Ltd. and Telcon-Magnetic Cores Ltd., both made very substantial contributions to the profits.

The Plastics Division has had a very successful year, with a substantial increase in turnover in certain products, particularly for the packaging industry.

There is every reason to believe that overseas investments will prove ever more valuable assets to the company in areas to which exports in future are likely to be prohibited or at least restricted in favour of local manufacture.

Toolpro Ltd. Output was substantially increased and profitability maintained.

Speaking generally, the company may be considered to have concluded a most satisfactory year in the light of current conditions. Profitability in the electrical industry, particularly in cables, can only be maintained by the utmost economy and efficiency in all operations. Everything possible is being done in this respect.

The electrical industry in all its branches must grow, and grow fast if, as a nation, we are to maintain our position in world affairs and continue to raise our standard of living at current rates of progress.

We start off the year with a reduced but healthy order book and a keen and competent staff of employees, all determined to see that 1958 will be a prosperous year in so far as the political and economic atmosphere permits. 3229

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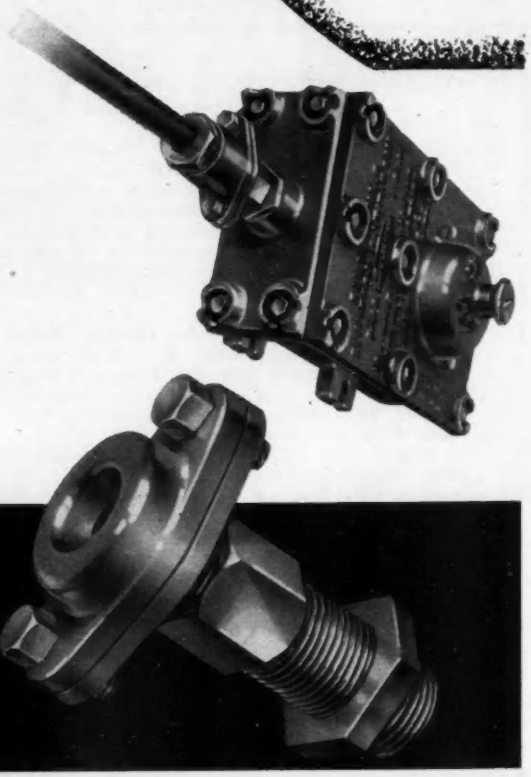

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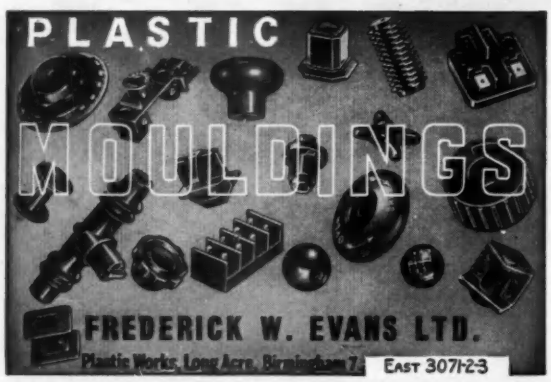

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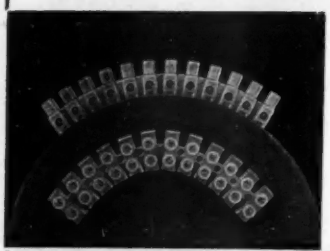

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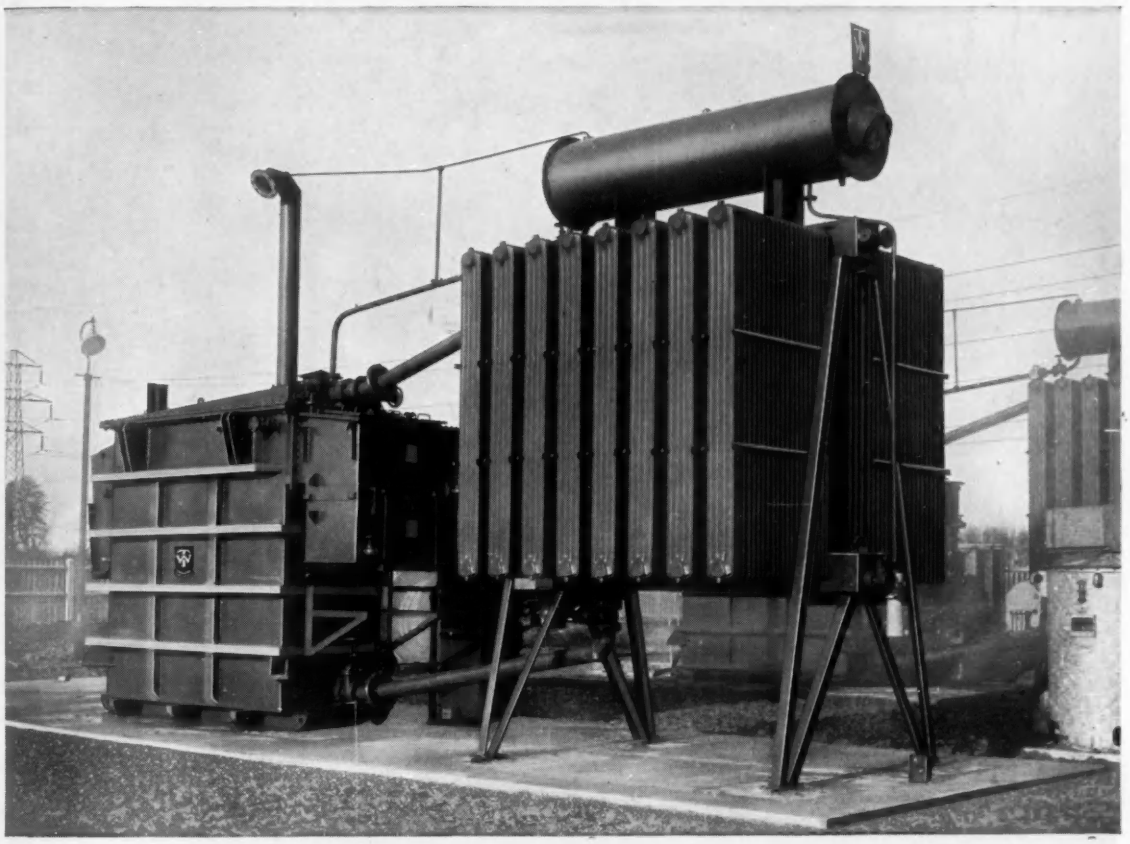

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